Electrical World

A McGRAW-HILL PUBLICATION

Calibrating Meters
For New System Frequency

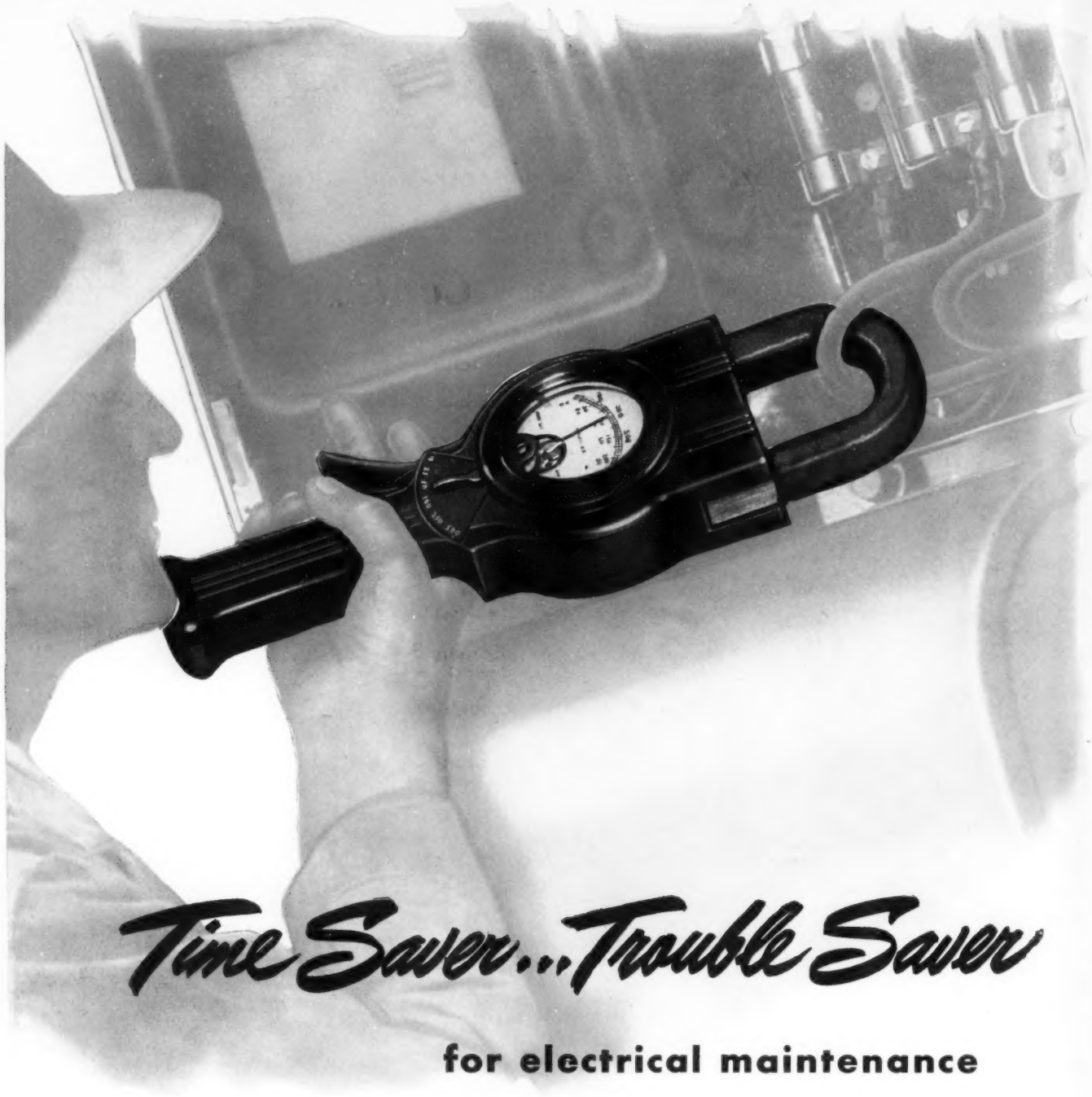
FEBRUARY 1, 1947

Features

Control of Demand Through Supervision

Mobile Radio Efficacy on 72 Mc. Confirmed

Economics of Low Load Density Distribution



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Electrical World

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February 1, 1947

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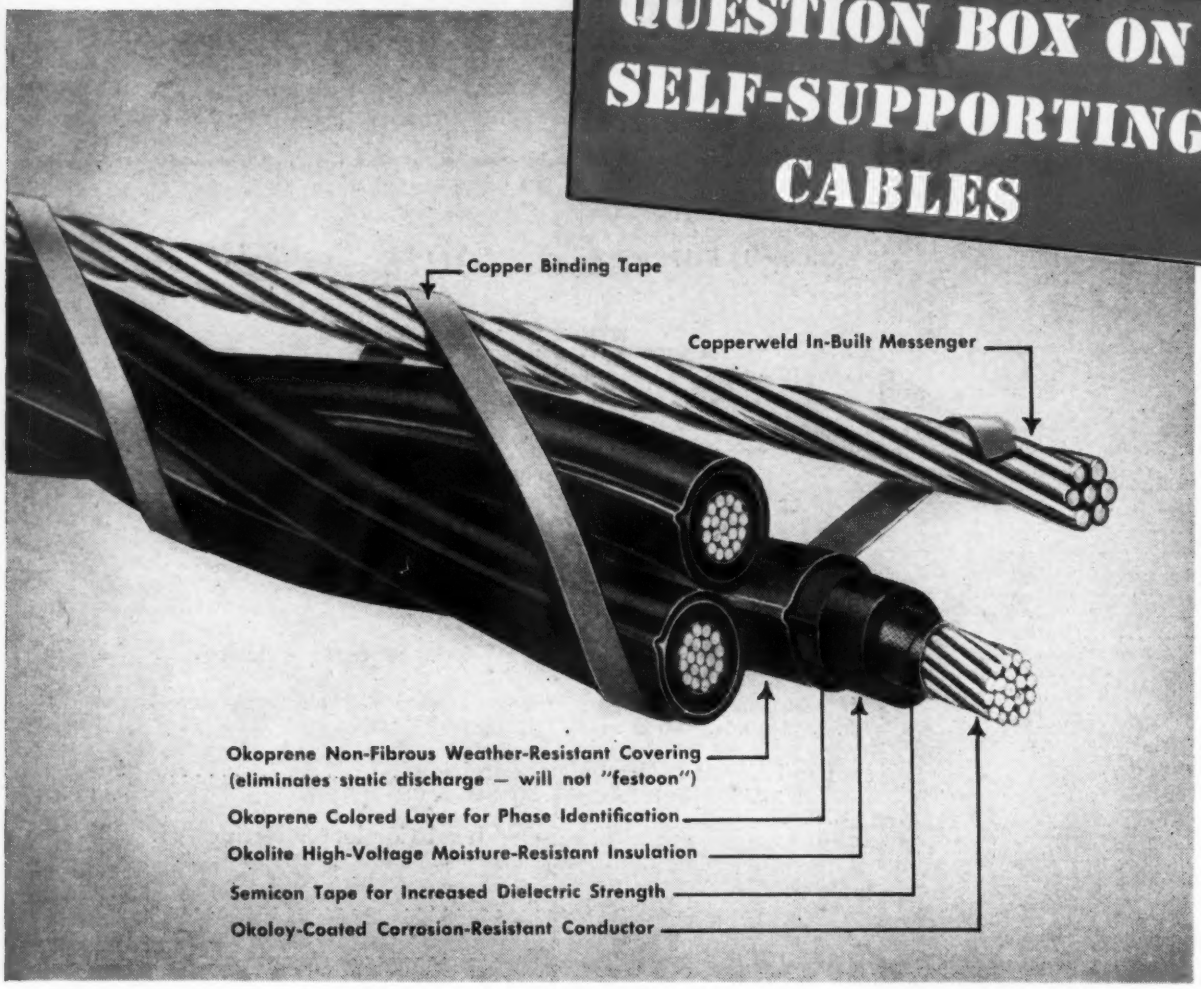
QUESTION BOX ON SELF-SUPPORTING CABLES


Copper Binding Tape
Copperweld In-Built Messenger
Okoprene Non-Fibrous Weather-Resistant Covering
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Okoprene Colored Layer for Phase Identification
Okolite High-Voltage Moisture-Resistant Insulation
Semicon Tape for Increased Dielectric Strength
Okoloy-Coated Corrosion-Resistant Conductor

QUESTION: What does "Self-Supporting" mean when applied to aerial cable?

ANSWER: It is an insulated power cable design that includes a messenger wire as an integral part of the assembly. It may contain one or more insulated conductors.

QUESTION: What *improvements in service* are gained through the use of such a cable?

ANSWER: It is designed to supplant open-wire construction by providing a fully-insulated cable that eliminates tree-trimming, reduces service interruptions, improves current regulation, cuts down pole congestion and reduces the clearances normally needed near structures.

QUESTION: What are some of the *economies* of Okolite-Okoprene Self-Supporting Aerial Cable?

ANSWER: It can be installed in a *single operation* requiring no separate stringing of messenger or placing of rings, it permits long spans, doesn't need overlength poles to clear tree tops, can operate in storms and even when poles are down.

QUESTION: What are some of the *unique features* of Okolite-Okoprene Self-Supporting Aerial Cables?

ANSWER: It does not require a lead sheath yet is permanently weather-protected with its Okoprene covering; it can be spliced by any lineman, does not require shielding up to 5000 volts and, when furnished with "Dualay" assembly is the *only self-supporting cable that can be tapped hot.*

QUESTION: How can I find out more about Okolite-Okoprene Self-Supporting Aerial Cable and its relation to my own distribution problems?

ANSWER: (1) By talking with Okonite engineers or (2) sending for the new 52-page manual on Self-Supporting Cable which contains complete engineering information, charts, tables, photographs, diagrams. Just ask for Bulletin OK-1033 when writing to The Okonite Company, Passaic, N. J.

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Electrical World

FEBRUARY 1, 1947

Virginia Protects the Public?

WHILE state and national legislatures have pondered legislation affecting continuity of public utility service, Virginia has written its plan into law. The plan is based on declared public policy which finds water, light, heat, gas, electric power, transportation and communication service "essential . . . to health, welfare and safety." It directs the state government to use "all available means and every power at its command" to prevent disruption of these services. It endorses collective bargaining; forbids lockouts; prohibits strikes until specified steps have been taken; authorizes the governor to seize and man threatened services, and prohibits interference with this process. It prohibits the government from granting a contract management would not grant; makes seizure unattractive to management and workers alike through dismissal and forfeiture of part of the profits; and provides fines of $10,000 daily for lockouts or strikes violating the act.

The public policy declaration regarding continuity of services, and the establishment of state duty to prevent their disruption can only be endorsed heartily. Many of the devices established to effectuate public policy are meritorious. It is difficult to express enthusiasm about the device of seizure, even in the face of a determination to strike such as was exemplified in Virginia a year ago, or in Pittsburgh several times last year. Certainly, if seizure must be authorized, it is most commendable that it be accompanied with provisions attempting to make it undesirable to both parties.

Entirely commendable also is the provision stipulating that those who work under seizure shall do so at pre-seizure wages and conditions. This should be an effective antidote to the "nationalization by default" which transpired in the coal industry because the government bought peace by writing a contract which management refused to write.

The law is inexplicit regarding just which utility employees may strike without invoking seizure. Thus, the implication is plain that if a utility strike be threatened which would not disrupt service, the state will not intervene. It is clear that such a strike, extended long enough, would cripple a utility's ability to render service —by impairing financial stability—just as effectively as a walkout of production workers. Such a program, indeed, was outlined at Atlantic City at the organizing convention of the Utility Workers Union of America, C.I.O., a year ago.

ELECTRICAL WORLD, however, still hopes for something better. Commendable as the objectives of the Virginia law are, ELECTRICAL WORLD retains its conviction that there is a better way. It reiterates a plan whereunder utility wages and working conditions are set automatically, kept abreast of those enjoyed by its customers, but where increases must be won outside the public service arena before being sought in an industry where a dispute regarding them might cause public suffering. Such a plan may be found in ELECTRICAL WORLD for October 26, 1946.

★ ★ NEWS OF THE

3,000 Attend A.I.E.E. Annual Winter Meeting in New York

Edison Medal Presented to Lee de Forest, John Fritz Medal to Lewis W. Chubb, Hoover Medal to Vannevar Bush—Subway Problems in New York City Discussed by Transit Executives

TRANSIT SPEAKERS—Maj. Gen. Charles P. Gross, left, chairman, Board of Transportation, New York City Transit System, with J. J. Sinclair and B. F. Cordts, both of the same system, before the three addressed the Light Traction session of the A.I.E.E. convention on Monday

NEARLY 3,000 members of the American Institute of Electrical Engineers met in New York this week for the annual winter meeting. All fields of electrical engineering were covered in the lengthy program which included the reading of 104 technical papers.

Three men prominent in the field of electrical engineering were honored during the meeting. They were Lee de Forest, dean of the American Television Laboratories, Chicago, and president of Lee de Forest, Inc., Los Angeles, who received the Edison Medal; Lewis W. Chubb, director of the Westinghouse Research Laboratories, who received the John Fritz Medal; and Vannevar Bush, chairman of the newly created Joint Research and Development Board of the Army and Navy, who received the Hoover Medal.

Dr. de Forest received the Edison Medal "for pioneering achievements in radio and for the invention of the grid-controlled vacuum tube with its profound technical and social consequences." He was presented for the medal by David Sarnoff, president of Radio Corp. of America, who said that the electron tube, invented by Dr. de Forest in 1906, was "one of the 20 great inventions of all time. . . . It is a significant fact that this invention has withstood the test of time over a period of 40 years and that it still continues to enlarge its field of usefulness."

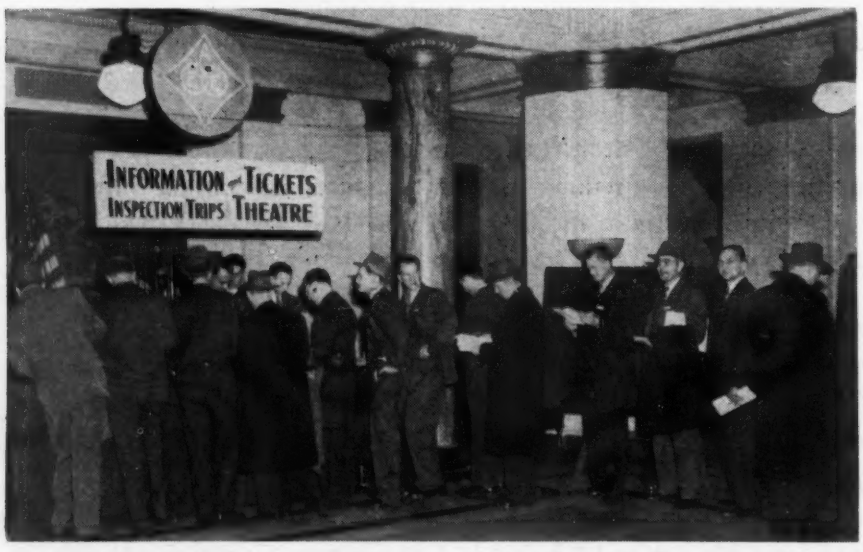
Dr. Chubb was presented the John Fritz Medal "for pioneering genius and notable achievements during a long career devoted to the scientific advancement of the production and utilization of electric energy." Nevin E. Funk, vice-president in charge of engineering, Philadelphia Electric Co., presented the medal; and Marvin W. Smith, vice-president in charge of engineering, Westinghouse Electric Corp., made the presentation address.

The medal, like the Hoover Medal, is awarded jointly each year by the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers, and the American Society of Mechanical Engineers.

"Never in the nation's history," Dr. Chubb said in his response, "has the scientific future been brighter. The machine age has furnished the brawn. The enormous electrical industry supplies the materials. Electronics has furnished the superhuman skills, and the atomic age—or better, the nucleonic age—is the resulting era of supreme significance.

"The lessons learned during the war show the great possibilities of applying scientific and engineering knowledge. We have today an enormous expansion of research and development aimed at applying scientific and engineering knowledge to peacetime advancement. For the present year, more than a billion dollars has been earmarked for industrial, governmental, and academic research.

"This vast program underlines the urgent need for highly trained scientists and engineers . . . Today there is a critical shortage of such men. The future of the nation's scientific program depends upon keeping a constant flow of trained men into industrial and governmental laboratories."



TICKETS—Tickets for the many inspection trips sponsored by the A.I.E.E. as part of its winter meeting program drew this line of eager recipients

ELECTRICAL WORLD ★ ★

ENGINEERS—Members of the A.I.E.E. in New York for the winter meeting mingle in the lobby of the Engineering Societies Building before the first session

The citation to Dr. Bush, winner of the Hoover Medal, read, "Engineer, educator, and administrator, who, in critical times of need, was in a most special sense an organizer, guiding spirit, and driving force of the nation's achievements in physical and medical science."

Visiting engineers, many of whom knew of the sorry state of New York City subways, either from experience or from the many newspaper and magazine articles which have appeared recently, received an explanation of the city's plans to modernize them at the Monday morning Light Traction session.

Maj. Gen. Charles P. Gross, chairman of the Board of Transportation, New York City Transit System, said that the trouble today is lack of money. He asserted that $150,000,000 is needed for rehabilitation and $500,000,000 for construction. He called for a 10-cent fare, fought by politicians for years, and predicted that even if the money were available as needed it will be 1954 before the subways will be able to catch up with the subway jams.

B. F. Cordts described the new cars which have been ordered for the subways, and J. J. Sinclair the "dream car" which is still on the drawing board. Both are engineers for the Transit System.

The technical papers which were read at the sessions and the pertinent discussion there will be given special treatment in the engineering section of the February 15 issue of ELECTRICAL WORLD.

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The Average House Costs?

A study of privately financed one-family housing in 18 scattered industrial areas of the nation has revealed the cost is averaging $7,400 per unit and in 15 non-industrial areas, $5,900 per unit; in both cases the figure is exclusive of land and development expenditures.

The study was made by the Bureau of Labor Statistics, and the results were revealed in a special release to McGraw-Hill's Washington Bureau. Approximately eight months will be required for most of the housing to be completed.

•

Municipal System Defeated

The largest number of voters ever to participate in a municipal election in Winter Park, Fla., turned out recently to defeat 1,068 to 124 a proposal that the city acquire the distribution system of the Florida Power Corp. Winter Park had a municipally owned and operated generating and distribution system until 1927.

Northwest Utilities Unite to Back Federal Program

Public and Private Bodies Join in Approving Policy Calling for More Federal Projects in Area

In a statement of policy by seven major electrical power generating and distributing agencies operating in the Pacific Northwest, approval was given to a program of development of federal generation capacity calling for a total output of 318,000 kw. beyond the 745,000 kw. now on order by November 1, 1949, and 1,565,000 kw. by November 1, 1953.

Meeting at Tacoma, Wash., with representatives of federal agencies having to do with reclamation, engineering, and power distribution, executives of the power companies in the area recommended continued federal development of multi-purpose dams on the Columbia River and its tributaries. Such a program, the executives declared, is the only basic solution of the Pacific Northwest's power requirements in its own, as well as the national, economy.

Chambers of Commerce in Seattle, Portland, Tacoma, and Spokane were asked to take over the program in an effort to obtain Congressional sanction. In this way it is proposed to present a solid front on the importance of continued development of power resources in conjunction with allied reclamation, flood control, and navigation purposes.

Additional Capacity Needed

Consolidated demands of various units in the area revealed that 226,000 kw. of new capacity will be needed by December, 1947—56,000 more by the end of 1948, and 36,000 more by the end of 1949, a total of 318,000. In excess of 300,000 would be needed annually for 1950, 1951 and 1952 and close to 300,000 in 1953, a total generating capacity estimated at 1,565,000 over the seven-year period.

The power executives made no mention of specific development, leaving this to the judgment of federal agencies involved and dependent on federal funds made available by Congress. They made it clear that private power distributors have held back from providing new plans to meet their own requirements in the belief that only the federal government can provide the vast quan-

tities of cheap hydroelectric power which the economy of the region demands. Instead they have united in the maintenance of the Northwest Power Pool as the most practical method of preventing premature shortages in any one part of the region at any time.

Signers of the statement were K. M. Robinson, president of the Washington Water Power Co.; F. M. Warren, Jr., executive vice-president of the Pacific Power & Light Co.; T. E. Roach, vice-president and general manager of the Northwestern Electric Co.; H. C. Webb, vice-president of the Puget Sound Power & Light Co.; E. R. Hoffman, superintendent of lighting, Seattle City Light, and C. A. Erdahl, commissioner of the Department of Public Utilities, Tacoma.

•

TVA Cuts Power Output to Provide Flood Control

Operating in accordance with its established procedures for flood control, the Tennessee Valley Authority reduced the levels of its reservoirs to provide storage capacity during the floods of early last week, a TVA spokesman told ELECTRICAL WORLD.

The result was a maximum reduction in available generating capacity in the order of 450,000 kw. High tail waters contributed to this reduction.

The major retention of flood waters was in the large by tributary reservoirs. On January 20, the combined outflow from the Cherokee, Douglas, Fontana, Norris, and Hiwassee dams was approximately 24,000 cu. ft. per sec. while the inflow was about 20,000.

The principal effect, however, which flood control procedures had upon hydro operations was to reduce the generating capacity available at the main river plants because the reservoirs were held at low levels.

More than half the capacity loss was at Pickwick and Kentucky dams where the maximum possible storage space was held available to protect against the possibility of flood flows on the Ohio and Mississippi reaching dangerous proportions. At Pickwick, where normal space reservation for flood control is from elevations 410 to 418, the reservoir was at elevation 408 during the period of maximum reduction of generating capacity. At Kentucky, where normal is from 354 to 375, the reservoir was held at elevation 350.

The spokesman said that contrary to rumors the flood was not considered excessive but that the storage reservoirs had reduced the stage at Chattanooga approximately 10 ft. There was no damage to any TVA facilities.

Atomic Energy Commission Confirmation Seems Certain

Opposition of Senator McKellar to Lilienthal not Likely to Bar Him—Advisory Committee of Utility Men to Be Picked to Advise Commission on Problems of Building Power Piles

SENATORS considering the confirmation of five appointees to the Atomic Energy Commission paid no attention in public hearings this week to the question of whether atomic energy ever will be made available for use by privately owned electric systems.

Mild attention was paid to the appointees' ideas on whether products and processes of the atomic revolution should be turned over to private hands when such a step could safely be taken. The committee accepted the assurance of each candidate that he would press for such a course when possible and laid almost no stress on the matter.

Of greatest interest to the electric power industry in the first three days of hearings was Chairman-designate David E. Lilienthal's assertion that an "advisory committee" of "utility men" would be organized by the commission to consult on problems encountered in the construction of nuclear reactors (pile) for power purposes. The commission, he said, has already conferred with patent attorneys for advice on commission policy in this regard.

Hearings Were Serious

Through mid-week, the hearings were serious, almost totally devoid of the antagonism which had widely been bruited by those who recalled the long-time feud between Sen. Kenneth McKellar, Tennessee Democrat, and Lilienthal, who resigned as chairman of the Tennessee Valley Authority to take the AEC chairmanship.

After somewhat lengthy interrogation of Lilienthal, Senate members of Congress' Joint Atomic Energy Committee questioned briefly the other members and the commission's new general manager. The plan then was to hold more or less extensive hearings behind closed doors and to reopen them for McKellar to pursue his long-standing feud with Lilienthal.

Other appointees are Robert F. Bacher, Cornell physicist; Lewis L. Strauss, New York banker; Sumner T. Pike, ex-Securities and Exchange Commission member and William W. Waymack, Iowa editor. Carroll Wilson, appointed as AEC's general manager, also was up for confirmation.

The feeling was that there would be almost no serious opposition to any of the appointees, including Lilienthal, and no chance whatsoever that any would fail of confirmation.

Pleads for Administrative Freedom

As hearings opened Monday, several Republican Senators made it plain that they would use the hearings to write an unmistakable record of their views on security of atomic information. They were joined by Lilienthal and his colleagues. The former objected to any ruling that members of the Military Liaison committee, established by the Atom-Control Act, or of the Joint Congressional Committee be authorized to attend every meeting of the commission. After some frank argument over the point, both sides returned Tuesday to qualify their positions and to reassure each other that there would be neither infringement of AEC's prerogatives nor withholding of information from the military.

Lilienthal repeated the latter assurance times without end, but pleaded for administrative freedom for the agency, which, he said, faced an unprecedented management job.

Under repeated questioning by Sen. Eugene Milliken, Colorado Democrat, as to whether he was "temperamentally fitted" to relinquish atomic-derived activities to private enterprise when this could safely be done, Lilienthal insisted that he was so fitted. He asserted that his record in TVA would show that private enterprise had been bolstered there by the agency of which he was a director for 13 years.

•

Strikers Pay Fines

The 14 striking employees of the Illinois Rural Electric Co., Winchester, Ill., who recently were found guilty of riotous acts against the construction crew of the co-op (ELECTRICAL WORLD, January 18, Page 126), this week paid a fine of $50 and costs each.

The strikers, members of the International Brotherhood of Electrical Workers, were also denied a new trial by Greene County Judge Julian Hutchens, who assessed the fines.

AT THE CLINIC—James Coatsworth, left., E.E.I.; O. K. Quivey, Baltimore & Ohio, R. R.; H. J. Gallagher, Consumers Powers Co.; T. F. Fulford, Virginia Electric & Power Co.; W. E. Parrott, Ebasco Services, Inc.; E. C. Easter, Alabama Power Co.; C. H. Leatham, Monongahela Power Co.; D. B. Leonard, Pacific Power & Light Co.; J. L. Davidson, Savannah Electric & Power; R. Reed, *Country Gentleman;* R. Godley, E.E.I.; A. Spurr, Monongahela Power; P. Monfort, Texas A. & M.

Area Development by Utilities Called Necessary at Clinic

For the electric utility, rural electrification is a much bigger job than just supplying electricity to farmers and teaching them how to use it profitably. This was the theme of the agricultural development clinic sponsored by the Edison Electric Institute at Fairmont, W. Va., January 24-25.

To be effective and successful, rural electrification activities must be broadened out into programs of area development in which utilities join hands with other forward-looking agencies of education and of business. That the idea of such cooperative effort is spreading among utilities was evidenced by the attendance at the clinic, which had been expected to be not more than 20 or 30, but which actually was nearly 150 and included representatives from 65 power companies in 35 states.

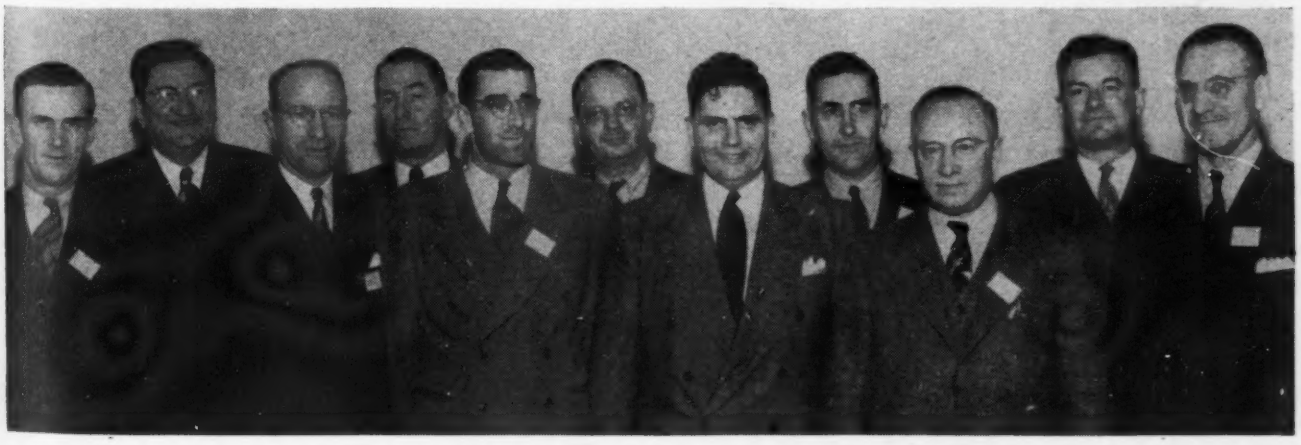
Essential to success of such programs, according to A. C. Spurr, president of the Monongahela Power Co., outlining the activities of the company in farm service, is clean-cut separation of efforts towards territorial development from the commercial interest of building up farm loads.

That separation of the two lines of activity does pay off was asserted by C. H. Leatham, vice-president of the company, who said that since the territorial development work got going, "We have found farmers as well as other people are our friends and like to do business with us. I am convinced that reduction in our cost of doing business is greater than the cost of our territorial development department."

Supporting evidence of the value of area development in building business was presented in talks by LeRoy Holt, Tennessee Coal, Iron & Railroad, and by O. K. Quivey, Baltimore & Ohio Railroad, and in a paper by Ralph Gale, Idaho Power Co. In each instance it was recognized that agricultural prosperity is the basis on which profitable business is built, and each company set about to assure that prosperity by helping to increase farm production, to establish marketing and processing facilities, and to increase area income.

That educational agencies and farm organizations welcome the help of the utility in the task of raising the living level and income of the farm population was made abundantly clear in addresses by four representatives of such groups in West Virginia—J. O. Knapp, Agricultural Extension Service; L. L. Lough, Soil Conservation Service; F. L. Miles, Farm Bureau; J. C. Boggess, county agent, Barbour County.

Much of the value of the clinic lay in the place it was held, where are centered the activities of the territorial development department of the Monongahela Power Co. Those present were given every facility to become acquainted with details of the department's operation through displays in the meeting room and through visits to project locations.



OTHERS AT THE CLINIC—R. R. Currey, left, Monongahela Power Co.; John Burgan, New York State Electric & Gas Corp.; R. G. Harvey, Niagara Hudson Power System; T. Keenan, Pacific Power & Light Co.; I. N. Fetty, Monongahela Power; J. E. Marino, Alabama Chamber of Commerce; J. L. Copeman, L. B. Swisher, Monongahela Power; Clyde Hine, Cleveland Electric Illuminating Co.; W. J. Gillespie, Appalachian Electric Power Co.; L. M. Holmes, Dayton Power & Light Co.

Doble Clients Study Gains in Preventive Maintenance

Progress in Insulation Testing Develops into Wider Areas of Service Protection—Research Stimulates Improved Ways —Advantages of Reconditioning Bushings Shown by Utility

TWO PRESIDENTS—J. Elmer Housley, left, president of the American Institute of Electrical Engineers and an employee of the Aluminum Co. of America, and Frank C. Doble, president of Doble Engineering Co., discuss a client-consultant problem

EXPANDING INTEREST in the maintenance of high quality electric service through analyses of insulation condition featured the 14th annual conference of Doble Engineering Co. clients at Boston, January 20-24. All sections of the continent were represented by the 206 registrants.

Progress was emphasized in the special fields of transformer, bushing, circuit breaker, cable, generator, and liquid insulation, based on research and operating property experiences. Papers by clients stressed improved techniques in field work, with increased attention to the economic values of insulation testing and its interpretation.

One large utility presented an economic study of maintenance testing which specifically pointed out that in the reconditioning of 1,246 bushings since 1940 at a cost of $30.451, net savings of $137,914 were realized against cost of replacement new. The percentage of bushings found defective each year is lessening. Preventive maintenance tests offer further benefits in relation to existing long deliveries and the ability to prolong the useful life of insulation. Most clients reported no unusual bushing failures in 1946. More attention is being given gaskets and bell-mouth breathers. Clients are using nearly 15,000 reconditioned bushings. In general a life expectancy of at least ten years is anticipated, with some higher figures in scattering amounts.

Failure of tap changers in operation because of contact trouble has led to a trend toward the use of tin plate contacts. More thought is being given to the design of tap changers to accord with maximum transformer outputs rather than maximum nameplate ratings. Increased attention is also being turned toward including power factor tests as a measure of the dryness of each winding before shipment from the factory, to establish a base line for future field tests. It was suggested that any power factor of 2 percent or more at 20 deg. C. should be cause for investigating insulation quality. Interest is spreading in the drying of transformers in service.

Methods of dehydrating breathers are being discussed, and criticism is noted as to the accuracy of determining the hot spot locations in transformer windings. Manufacturers are designing transformer bushings to provide better facilities for field testing. Procedures are being developed for collecting condensation in free breathing transformers and progress is noted in purifying transformer oil in the field, with the development of basic data on so-called "quality factor" lines.

Most clients reported no circuit breaker failures in 1946. Exceptions were two cases of wet lift rods (138 kv.), improper adjustment after modernization, opening a 13.2-kv. disconnect switch under load by error (a 1.5 million-kva. breaker failed), excessive carbon inside the porcelain arc shield of a bushing. Contacts have required some attention.

Increased interest was shown in liquid insulation research and testing as well as in oxidation tests of lubricating oil. Advances have been made in the laboratory and in field maintenance methods. Notable progress has been made in applying such tests to network transformers, including the submersible type, at

CLIENT DELEGATES AT DOBLE CONFERENCE—C. W. Anthony, left, Oklahoma Gas & Electric Co.; W. F. Dunkle, Pennsylvania Power & Light Co.; V. Stevens, Electro-Metallurgical Co.; C. W. Andrews, Ohio Power Co.; N. A. Hooper, Ohio Edison Co.; P. C. Pray, New England Power Service; E. L. Schlottere, Philadelphia Electric Co.; O. E. Fawcett, West Penn Power Co.; and I. W. Gross, American Gas & Electric Service Corp.

the time of changing insulating oil. Steps have been taken to define the requisites of a satisfactory liquid insulation. Oil reclaiming plants are coming into wider use, and methods of eliminating sludge, notably by the "thermosiphon" treatment, are attracting attention. Record systems are better.

Lightning arrester testing has advanced, notably in connection with study of the effects of weather conditions and resulting better testing techniques. In 1947, the best test voltages for such equipment will be investigated.

No clients have observed unusual change in the physical or chemical behavior of the new synthetic insulations. In the generator field clients reported upon many phases of machine protection, including insulation testing, grounding neutrals, alarms, corona, dielectric absorption tests and other practices. Many variations in practice were noted and the subject is an active one among clients, whose total installed generator capacity including synchronous condensers now covers about 10 million kva.

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Hartford Electric Replacing Mercury Unit with Another

Hartford Electric Light Co. will replace its mercury vapor boiler and will rebuild its mercury turbine unit at its South Meadow station to gain an additional 10,000 kw. of firm capacity and achieve an annual fuel saving of over $300,000. About $2,000,000 will be expended on the program, and installation is to be completed by the end of 1948.

The replacement boiler is to be built by Foster Wheeler Corp. General Electric Co., builder of the mercury units pioneered by the utility at Dutch Point and South Meadow, has designed the boiler along the general lines of the installation at the Kearny, N. J., station of the Public Service Electric & Gas Co. General Electric will also rebuild the turbine, which has been delivering about half of its 10,000-kw. nameplate rating, to 15,000 kw.

The decision to replace the original mercury unit at Hartford was made after a study of the fuel economies realized in nearly 25 years of operating experience. The new unit is expected to save about $800 to $900 a day, when operated in coordination with the existing steam units in the plant. In this time, the service reliability of the mercury cycle has been brought to a high level of availability, reaching 84 percent in 1945 (ELECTRICAL WORLD, July 6, 1946, page 84).

Allis-Chalmers Election Gives Local Victory But No Majority

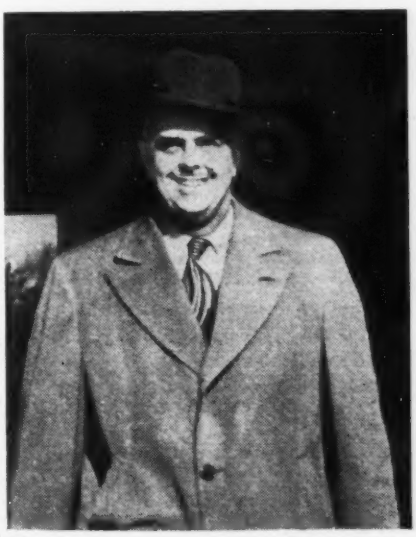
Striking Union Defeats Independent Group by 107 Votes but Count of 50 Challenged Ballots Will Determine Which Has Majority—Firm Awaits Notification by Board of Winner

THE FAILURE of Local 248, U.A.W.-C.I.O., present bargaining agent of West Allis employees of Allis-Chalmers Manufacturing Co., to secure a majority, though it won by 107 votes, in the special bargaining election held Sunday laid the groundwork for legal controversy which will contribute nothing to ending the 308-day-old strike.

Of the 8,303 votes cast, Local 248 received 4,122; the independent group which petitioned for the election, 4,015; no union, 116. An additional 50 votes were challenged. These votes will be studied; and if Local 248 can win 30 of them, it will have necessary majority.

Most of the 50 votes were challenged on the basis that those voting are no longer on Allis-Chalmers payrolls and therefore not "entitled to vote." These men have for the most part obtained other employment and have voluntarily severed connections with Allis-Chalmers.

J. E. Fitzgibbons, member of the Wisconsin Employment Relations Board which conducted the election, declared if no majority were obtained, the election would be declared "no contest," and the independent's petition for the election would be dismissed. On this basis, Local 248 would be the winner.



MEDIATOR CLERGYMAN — Rev. Ensworth Reisner, Milwaukee minister, in whose home last week officials of Allis-Chalmers Manufacturing Co. met with officials of U.A.W.-C.I.O., in an effort to reach an agreement which would end the strike at the West Allis plant of the company

However, officials of the independent union take a different view and have already informed Allis-Chalmers officials that according to state law, the company would be acting illegally should it recognize or negotiate with any union not obtaining a clear-cut majority. This is reported by sources close to the situation as the first step in the independent's strategy in demanding a new election.

Walter E. Petersen, president of the independents, stated that further action by his group as to bargaining rights would be decided by the strategy group at a later date. He added, "The independent union has given the working people their first opportunity in years to decide the issues by secret ballot." He advised "all workers to return to work while a settlement of differences as to honest and sincere collective bargaining could be worked out."

R. J. Thomas, director of the strike and vice president of C.I.O., in a statement interpreted the results as "a triumph for all organized labor." He also called for "an immediate resumption of negotiations" with Local 248 and a speedy settlement of the strike.

Allis-Chalmers Statement

James M. White, vice-president in charge of manufacturing at Allis-Chalmers, issued the following statement:

"The company has received no official announcement from the Wisconsin Employment Relations Board that any union has received a majority of the votes cast. Regardless of what the official announcement may be we wish to give all employees who have returned to work the knowledge that their rights and privileges will be fully protected at all times. The company will continue to maintain its policy that no man's job at Allis-Chalmers will be dependent upon membership in any union.

L. E. Gooding, chairman of the state board, stated that the challenged ballots, which were set aside in sealed envelopes during the balloting, would be considered at a meeting of interested parties in the near future.

Ground Tests Clarified

To the Editor of ELECTRICAL WORLD:

My article entitled "Thorough Grounding Pays Dividends in Service" which was published in the January 4, 1947, issue of ELECTRCAL WORLD contained the following paragraph.

"As to improvements that have been made in equipment since the program began, we started out using a magneto type ground Megger to measure the resistance. We soon found that this instrument was affected by stray ground currents and in some cases it was impossible to get any reading at all. For the past two years, we have used a battery type ground tester which has proven very satisfactory in operation."

I wish to advise that my use of the term megger in this paragraph was that of a resistance measuring instrument just as the term voltmeter is used throughout the industry to describe a potential measuring instrument. The term was not used as a trade name, and it certainly was not intended to designate an instrument of any particular manufacture.

Our ground testing crew was unable to obtain dependable reading of ground resistance with a magneto type ground testing instrument under certain conditions. However, had the operator of the instrument been aware of the fact that extraneous voltages at different frequencies could be eliminated by simply operating the crank of the instrument at a different speed, it is entirely possible that satisfactory readings would have been obtained. As a matter of fact, we have recently used a "Megger" ground tester to re-read a ground where extraneous voltages had previously prevented us from obtaining a reliable reading. The results on this test were entirely satisfactory, even though the extraneous voltages were still present.

It is a pleasure for me to make this correction, and I would appreciate your publishing it.

R. C. Stevenson, Jr.
Electric Power Board of Chattanooga
N.W. Cor. 6th and Cherry Sts.
Chattanooga 2, Tenn.

["Megger" is held as a trade mark by Evershed & Vignoles and their American licensee, James G. Biddle Co.—*The Editors*]

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10-Year Franchise Granted

Citizens of Pembroke, Ont., on December 9 voted nearly 3 to 1 to renew the franchise of the Pembroke Electric Light Co. for ten years. Pembroke was the first city in Canada to have a commercial electric lighting plant (1884), and the company is one of the few privately owned and operated public utilities in the Province of Ontario.

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Rural Loans Approved

The Rural Electrification Administration in December announced loans totalling $15,931,000 to 54 cooperatives and seven public power bodies in 26 states and Alaska. Most of the loans were for the construction of lines, of which 7,828 miles are to be built to serve 23,036 customers.

MEETINGS

Great Lakes Power Club—Meeting, Palmer House, Chicago, February 14. J. H. Miller, secretary, Indiana & Michigan Electric Co., Marion, Ind.

Institute of Radio Engineers—National Convention, Hotel Commodore, New York, March 3-6. James E. Shepherd, chairman, Institute of Radio Engineers, 1 East 79th St., New York 21, N. Y.

Radio Engineering Show—Grand Central Palace, New York, March 3-6.

Previously Listed

Edison Electric Institute—Prime Movers Committee, Van Curler Hotel, Schenectady, N. Y., February 3-4; Industrial Power and Heating Section, Hotel Continental, Kansas City, Mo., February 5-7; Transmission and Distribution Committee, Atlanta Biltmore Hotel, Atlanta, Ga., February 10-11; Meter Committee, Robert Treat Hotel, Newark, N. J., February 10-12; Electrical Equipment Committee, Atlanta Biltmore Hotel, Atlanta, Ga., February 12-13; Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 31-April 3.

Missouri Valley Electric Association—Annual Power Sales Conference, Hotel Continental, Kansas City, Mo., February 5-7.

Association of Edison Illuminating Companies—Committee on Metering and Service Methods, joint meeting with E.E.I. Meter Committee, Robert Treat Hotel, Newark, N. J., February 10-12.

Pennsylvania Electric Association—Systems Operation Committee, Lord Baltimore Hotel, Baltimore, Md., February 13-14. Electrical Equipment Committee, Penn-Harris Hotel, Harrisburg, Pa., February 20-21. Transmission and Distribution Committee, Penn-Harris Hotel, Harrisburg, Pa., February 20-21.

American Society for Testing Materials—Spring meeting and committee week, Benjamin Franklin Hotel, Philadelphia, Pa., February 24-28.

American Society of Mechanical Engineers—Spring meeting, Mayo Hotel, Tulsa, Okla., March 2-5.

National Electrical Manufacturers Association—Spring meeting, Edgewater Beach Hotel, Chicago, March 3-5.

Canadian Electrical Association—Western conference, Hotel Vancouver, Vancouver, B. C., March 3-5.

Midwest Power Conference—Palmer House, Chicago, March 31-April 2.

Southeastern Electric Exchange—Spring Conference of the Engineering and Operation Section, Sheraton Bon Air Hotel, Augusta, Ga., March 20-21.

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

WASHINGTON RAILWAY & ELECTRIC Co. has been permitted to purchase from the Washington & Rockville Railway Co. 19,250 shares of Braddock Light & Power Co., Inc., capital stock. The shares acquired from Rockville Railway together with Braddock's remaining 50,000 outstanding shares already owned by Washington Railway will be sold by that company to Potomac Electric Power Co. for $632,500 cash. Potomac will loan to Braddock up to $14,000,000 to be secured by 3½ percent promissory notes. The loans will be used to finance the construction of a generating plant. The companies, all of Washington, D. C., are part of the North American Holding Co. system. (Release No. 7116).

EASTERN NEW YORK POWER CORP. has ceased to be a holding company under an order recently issued by the commission, which ruled that the company now does not directly or indirectly own, control or hold with power to vote outstanding securities of a public utility company. (Release No. 7133).

NORTH AMERICAN Co.'s proposed sale of the St. Louis County Gas Co. to Laclede Gas Light Co. will go before the commission at a hearing which has been postponed from January 16 to February 5. St. Louis County counsel requested the postponement because of a hearing on the sale scheduled before the Public Service Commission of Missouri. (Release No. 7132).

GENERAL PUBLIC UTILITIES CORP.'s application filed jointly with that of one of its principal subsidiary public utility companies, NEW YORK STATE ELECTRIC & GAS CORP., requesting permission to undertake several transactions, has been approved. Under the authorized program, the parent company will make a capital contribution of $7,500,000 to the subsidiary prior to the latter's refinancing of its outstanding preferred stock and part of its outstanding bonds. New York State Electric & Gas plans to sell at competitive bidding $13,000,000 of first mortgage bonds, due in 1977, and 150,000 shares of cumulative preferred stock. The corporation will use part of the proceeds to redeem at 105¾ its $13,000,000 of 3¾ percent first mortgage gold bonds, due in 1964, and all 120,000 shares of 5.1 percent cumulative preferred stock at 105 percent. Of the remainder, $8,800,875 will be placed in escrow for new construction and the rest will be applied to the payment of interest and dividends on securities to be redeemed and to the payment of financing costs. (Release No. 7130).

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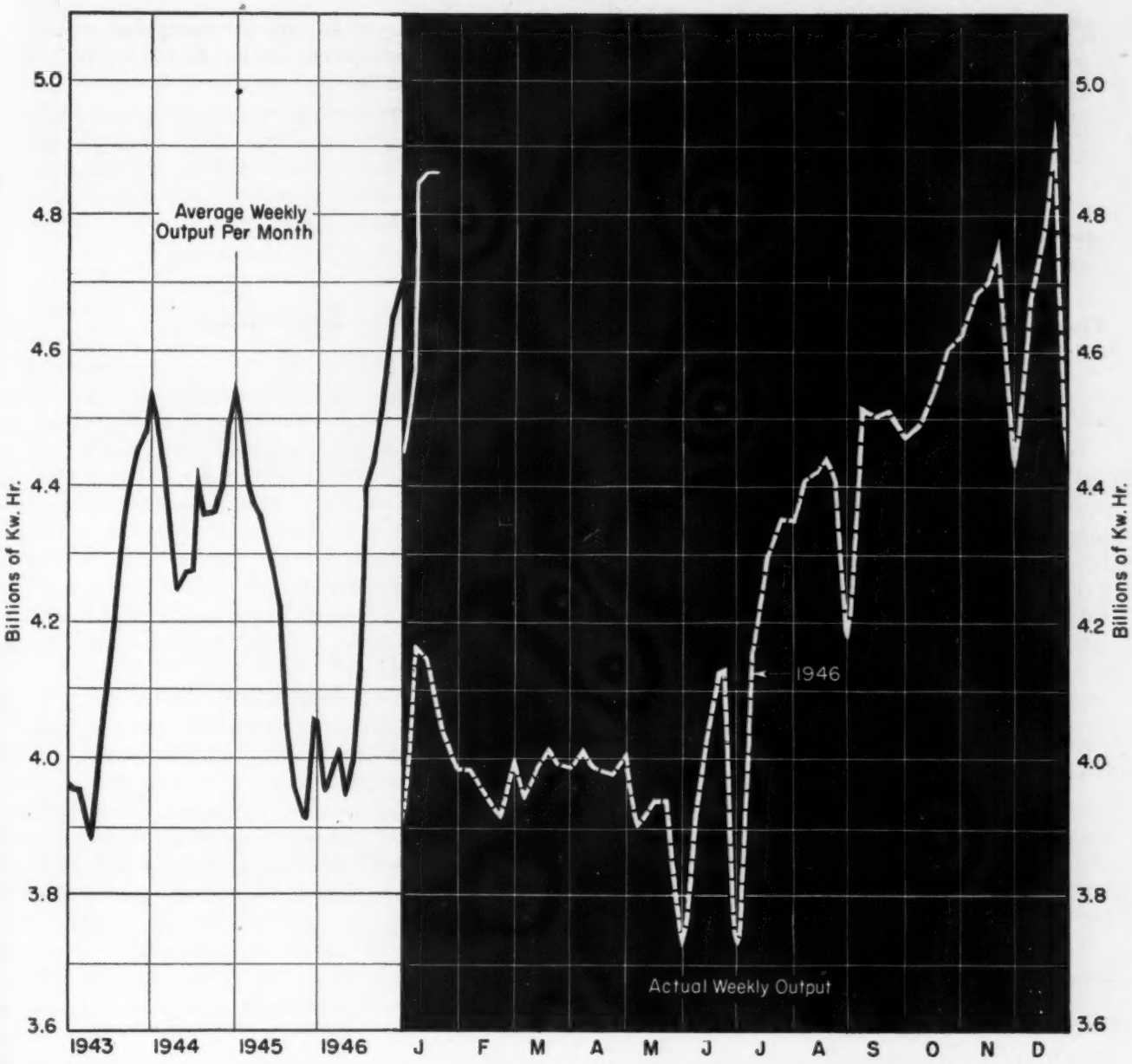
Second Unit Ordered

Southwestern Gas & Electric Co. has ordered a 25,000-kw. unit for its Lieberman plant on Caddo Lake, La., where a 20,000-kw. unit is to go into operation this year.



Badger Co-op Case Ended

The suit by which the Badger Electric Cooperative sought judicial review of a Public Service Commission refusal to approve sale of the Wisconsin Hydro Electric Co. to the co-op has been thrown out of court by Circuit Judge Sachtjen at Madison because the Badger contract to purchase the utility had terminated, so the question no longer exists.

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Will Double Capacity

Canada Electric Co., Amherst, N. S., will double the capacity of its steam plant at Maccan by adding a 20,000-hp. steam unit. A new transmission line between Truro and Maccan will tie in the plant in a grid covering northern Nova Scotia.

Electric Output Curve Turns Downward

No substantial change occurred in the output curve during the week ended January 25, 1947, according to figures released by the E.E.I.

The amount of electrical energy distributed by the light and power industry during the week amounted to 4,856,404,000 kw.-hr., comparing with 4,856,890,000 kw.-hr. during the preceding week. During the week ended January 26, 1946, the amount of electrical energy distributed totaled 4,034,365,000 kw.-hr., this year's figure representing an increase of 20.4 percent.

Each of the seven geographical regions showed higher increases than were reported the preceding week as compared with the 1946 corresponding week. The Central Industrial group took the lead from the Pacific Coast states, reporting an increase of 26.7 percent, but the latter group ran a close second with an increase of 26.2 percent.

Weekly Output, Millions Kw.-Hr.

1947		1946		1945	
Jan. 25	4,856	Jan. 26	4,034	Jan. 27	4,577
Jan. 18	4,857	Jan. 19	4,145	Jan. 20	4,588
Jan. 11	4,853	Jan. 12	4,163	Jan. 13	4,614
Jan. 4	4,574	Jan. 5	3,865	Jan. 6	4,427
1946		1945		1944	
Dec. 28	4,442	Dec. 29	3,759	Dec. 30	4,226
Dec. 21	4,940	Dec. 22	4,239	Dec. 23	4,617
Dec. 14	4,778	Dec. 15	4,154	Dec. 16	4,563
Dec. 7	4,673	Dec. 8	4,097	Dec. 9	4,538
Nov. 30	4,448	Dec. 1	4,043	Dec. 2	4,524
Nov. 23	4,765	Nov. 24	3,841	Nov. 25	4,369
Nov. 16	4,700	Nov. 17	3,985	Nov. 18	4,450
Nov. 9	4,682	Nov. 10	3,948	Nov. 11	4,397

Percent Change from Previous Year

	Jan. 25	Jan. 18	Jan. 11
New England	+13.2	+10.4	+12.7
Mid-Atlantic	+10.7	+10.1	+10.2
Central Industrial	+26.7	+18.5	+15.1
West Central	+15.4	+13.8	+ 7.6
Southern States	+22.4	+22.0	+23.8
Rocky Mountain	+10.5	+ 8.6	+11.8
Pacific Coast	+26.2	+23.8	+24.7
Total United States	+20.4	+17.2	+16.6

Electrical World
OPINION

The Closed Shop Is Vicious

NO EMPLOYER should be permitted to contract with a union requiring an employee to belong to any organization in order to work.

A closed shop agreement requires all employees to be members of a union and to maintain such membership in good standing. No doubt some political parties might enjoy a situation requiring voters to remain party members in good standing or lose their jobs. Possibly short-sighted church leaders might welcome a condition requiring members to remain in good standing with the church or lose their jobs.

No man's job should depend upon his being and remaining a member in good standing of any organization—church, lodge, or union—upon pain of losing his job.

The closed shop is a tool which gives control over the economic life of a worker—or a nation—to a union leader. Every miner recently on strike at the instigation of John L. Lewis knew that if he returned to work without authority from Lewis, he was subject to loss of his right to work as a miner.

The U.M.W.A. has a closed shop contract. If it declared such a miner in bad standing, he could never work at his trade until the union changed its verdict.

The Union Electric Power Co. was struck recently, after it was asked to suspend for two weeks an employee out of favor with a union. The company had a maintenance-of-membership agreement with the union requiring it to discharge employees who might fail to maintain union membership in good standing.

The union, however, asked for suspension, something the company was not required to do. Correctly, the company refused to suspend; so the union struck.

During the strike, the union changed tactics, declared the man in bad standing, and asked his discharge. This the company did as required by its contract, and the strike was ended.

This shows the tremendous power over a man's job which this device places in the hands of union leaders. In effect, it creates a monopoly of labor. By restricting union membership to a limited few, a scarcity is created. There are unions in New York City, for example, which limit membership to "the *legitimate* male heirs of existing members."

The closed shop, or any of its variations—union shop, preferential shop, or maintenance-of-membership—is vicious. It should be outlawed throughout industry and commerce, but especially in the electric utility industry. As pointed out in ELECTRICAL WORLD, October 26, electric utilities are in no position to resist arbitrary union demands. This issue is one which can be settled by legislation. It is an unsound, undemocratic practice, one from which workers should be protected by making it unlawful for employers to agree to such measures.

Curious, Not Inquisitive

ALMOST EVERYWHERE the loads on residential circuits are going up but hardly anywhere is there confident explanation of the reasons or even knowledge of the character of the increased demand and usage. Such amazement and perplexity seem unnecessary when a little curiosity might generate momentum enough to arouse genuine interest. That, of course, would mean a survey, or poll, or an inquiry or a contest—whatever would bring forth the most usable information with least effort and outlay. Fair generosity as to effort and outlay might bring forth further evidence of good standing of the utility with the consuming public.

Distribution engineers in particular are crying for just such data about the current thinking and prospective intentions of the patrons of the electric utilities. Without a better picture of the future load curve they are forced to do a certain amount of "by guess and by Providence" planning out in the penumbras of fact. Commercial departments need this information too, but not half so desperately as the system planners and distribution designers. Such information has been rounded up in some areas from the industrial and commercial users. But it is often comparatively easy to modify facilities to meet the errors in prognostication of these loads. The curiosity about the residential loads should be equally energetic because they are more numerous, more diffused, more diluted and more costly per kva. in revenue terms.

Without being obnoxiously inquisitive, there can be a wholesome curiosity about those hopefully good consumer loads.

Department Stores Selling Appliances

MUCH more than before the war, department stores are merchandising electric appliances. Presently, with demand high and supply low, store operators are discovering that appliance selling is easy and profitable. So it appears from discussions at the recent convention of the National Retail Dry Goods Association.

From the standpoints of appliance manufacturers and of electric utilities, this enlarging interest is fine. Manufacturers see therein widening distribution channels for their products. Utilities see more load and more revenue.

If their eyesight be keen, they will detect something further—the fact that electric appliances require service.

Successful department store operators are merchandisers, first, last and all the time. Their job is selling. It may very well be that some of them, wholly absorbed by their duties, will appreciate insufficiently or not at all the necessity and importance of appliance servicing. In such cases, manufacturers will lose through damage to the reputations of their products, and utilities will lose by reductions in load and revenue.

Such losses can be avoided if every electric appliance sale is backed by a guarantee of adequate service. It is up to the appliance manufacturer and to the utility to insure that the appliance purchaser has that guarantee of service adequacy.

Toward Stricter Benefit Ratios?

SEN. ROBERT A. TAFT has predicted that the U. S. Corps of Engineers may find itself required by the 80th Congress to raise its standards governing the determination of whether a multi-purpose water control project is economically justified. If he turns out to be correct—and this feeling has been voiced by others—there will be a lot less struggle over the erection of new federally owned transmission lines connecting these dams with load centers than otherwise might be expected. Army dams have been authorized on benefit ratios of less than 1.1 to 1, including such benefits as recreation. Any stricter Congressional interpretation of the traditional benefit ratio, added to the heavy increases in construction costs, would just about preclude construction of the more marginal projects which have been authorized or which have been proposed to date.

Now He Tells Them

INTERIOR SECRETARY KRUG has notified soft coal operators of the government's desire that they undertake negotiations with the United Mine Workers aimed at returning the pits to private operation after seven months in government possession. After seven months of nationalization which no one wanted, a strike which no one could afford, and a challenge to public authority which no one savored, the administration apparently concedes that management and labor, not government and labor, are the proper vehicles for the exercise of collective bargaining.

Without attempting to deprecate the necessity for seizing the mines which existed as a result of last spring's 59-day coal strike, one can wish that the government has learned the lesson. The seven months of fruitless government possession, and the humiliation of federal authority which accompanied them might prove worthwhile if they lead to a federal policy whereunder collective bargaining is free to and does function under adequate ground rules without recourse to government participation.

WASHINGTON COMMENT

By R. N. LARKIN

CERTAIN participants in the development of controlled nuclear fission and legislation governing it feel that two vital policy decisions having the broadest effects upon application of atomic energy to generation of electric power face the Atomic Energy Commission. They are:

1. Whether meticulous interpretation of the Atomic Energy Act is really necessary.
2. Whether the U.S. supply of uranium be sufficient to permit its use for power generation.

Under law, nuclear fission is applicable to power generation other than by the Commission only under AEC license, which may issue only to processes not creating new fissionable materials. Some regard such construction of the Act as unnecessary. Purpose of the law is complete, dependable protection against misuse of a demonstrably dangerous phenomenon. But protection of atomic-electric generation can be accomplished short of the stringencies stipulated by the Act.

A power plant can buy nuclear fuel from the government, confined in a can ready to be thrust into a power pile. Its contents used to exhaustion for power purposes, the can may be removed and returned. While it will contain new fissionable materials, and technically violate the act, they will be valueless until separated in a process beyond concealment. As for theft of the can containing the raw materials for an A-bomb—the main thing the Atomic Energy Act is designed to prevent—radiation emanating from such a used container is better protection than a thousand laws could afford.

On such a basis, then, intelligent and informed opinion does not consider that the meticulous provisions of the Act need constitute a major obstacle to the adoption of nuclear fission by the nation's existing power industry. AEC, of course, will have to decide.

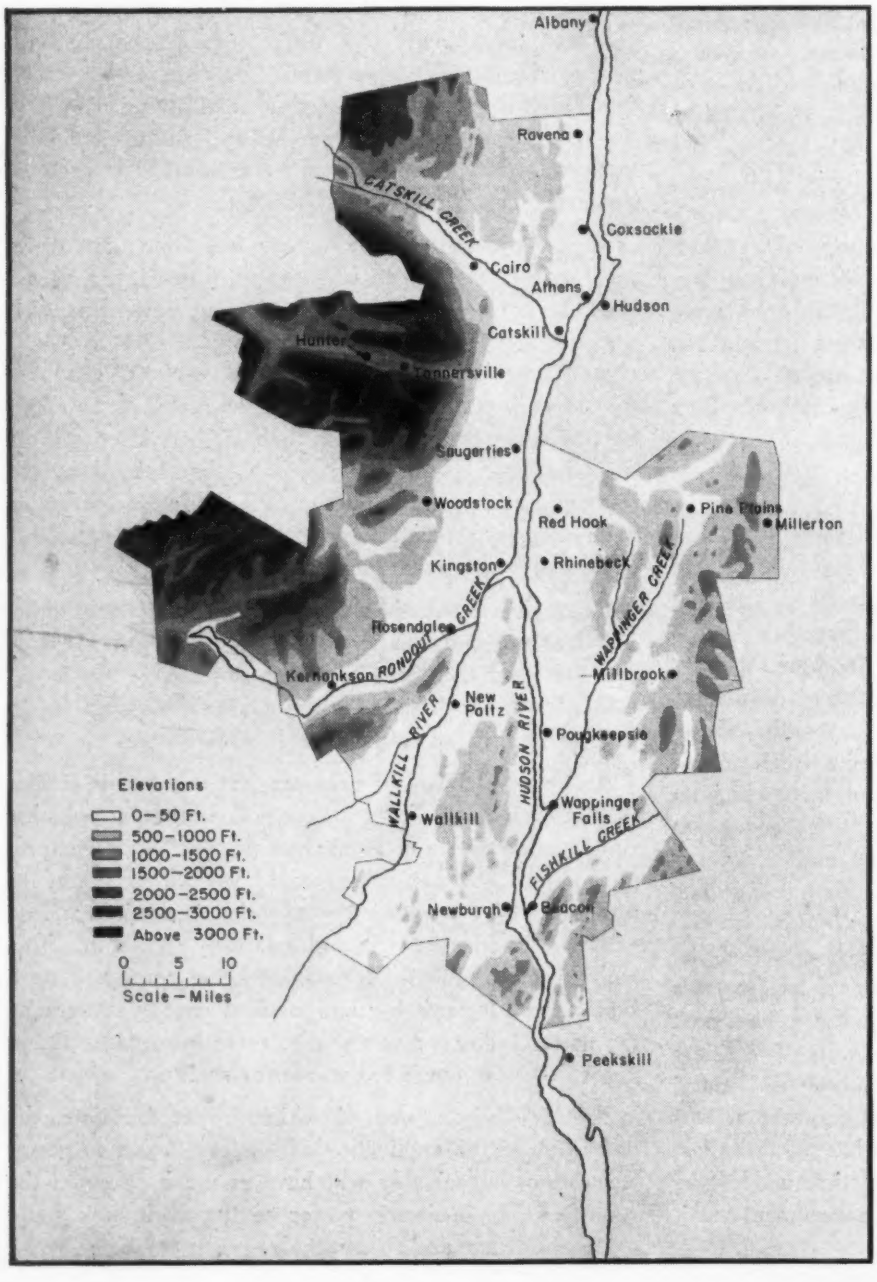
As for availability of uranium, the problem is similar to that facing the Federal Power Commission—whether conservation demands control of the end use of natural gas. Shall our limited natural gas, which might be highly useful elsewhere, be expended beneath a boiler, FPC has wondered? Should relatively scarce uranium, with broad promises of usefulness, be consumed as a replacement for existing and efficient energy sources by the power industry? Presently, some informed opinion holds that uranium is too scarce for such use.

These decisions, one of which might facilitate, the other hinder the application of nuclear fission to power generation, conceivably will have as much effect on the future of atomic-electric power as the work now going on at Oak Ridge and Schenectady.

Tests Confirm Efficacy Of 72 Mc. for Mobile Radio

G. H. UNDERHILL, *Assistant to Chief Engineer, Central Hudson Gas & Electric Corp.*

Adoption will escape congestion in 30-40 mc. band—Better than expected coverage demonstrated in typical Eastern mountainous area



POPULAR BELIEF is that radio transmission at frequencies above some 40 megacycles is pretty much a line-of-sight matter and that use for a mobile radio system by electric utilities serving somewhat extensive mountainous areas would be quite ineffective. Field tests on the Central Hudson Gas and Electric system, however, indicate that the performance is much better than such belief would contemplate. In fact the company is now installing a 75.66-mc. system following approval of its application by the FCC.

During July and August, 1946, the Central Hudson Gas & Electric Corp. of Poughkeepsie, N. Y., conducted a series of extensive tests to determine the relative capabilities of the 30-40 mc. and the 72-76 mc. bands as the basis for a mobile radio system covering its entire franchise territory. It is located in eastern New York and extends along both sides of the Hudson River between Peekskill and Albany. The area is approximately 2,500 square miles with greatest length 85 miles and width 60 miles (See Fig. 1).

Operating headquarters of each of the four divisions are located directly adjacent to the Hudson River at points where the elevations vary from

FIG. 1—Service area of CHG&E is mountainous along its eastern and western boundaries. Elevations are as high as 3,500 ft. Nevertheless two-way radio communication with four fixed stations on 72 mc. is satisfactory throughout 97 percent of the area, expressed in terms of customers

70 to 250 ft. above sea level. During normal working hours each division dispatches its own crews and it was considered essential that the radio system conform to this arrangement.

The obviously desirable answer was to locate a fixed transmitter at each of the operating headquarters where it would be provided with ample emergency power and where no telephone lines would be involved. Such an arrangement posed very serious propagation problems and careful study of the topographical difficulties led to the conclusion that neither the 152-162 nor the 72-76 mc. band could possibly provide adequate service from the headquarter locations without resort to excessively high antenna structures. It was, therefore, decided to conduct initial tests from each of the four locations with 30-40 mc. equipment.

Equipment for Initial Tests

Since the proposed fixed stations would be only 16 to 20 miles apart, powers higher than 50 watts were ruled out and the tests were made using 50-watt fixed and 30-watt mobile units.

General Electric equipment operating on 31.02 mc. was used at Catskill, Kingston and Poughkeepsie, and Link equipment operating on 39.54 mc. at Newburgh. Both used vertical, concentric di-poles and the antenna heights and elevations follow:

Location	Height (ft.)	Elev. (ft.)	Noise (Microvolts)
Catskill	85	310	1.0
Kingston	45	305	1.8
Poughkeepsie	95	165	1.0 to 3.0
Newburgh	65	320	0.3

Results of these field tests have been plotted on Fig. 2, which shows only a few typical readings out of

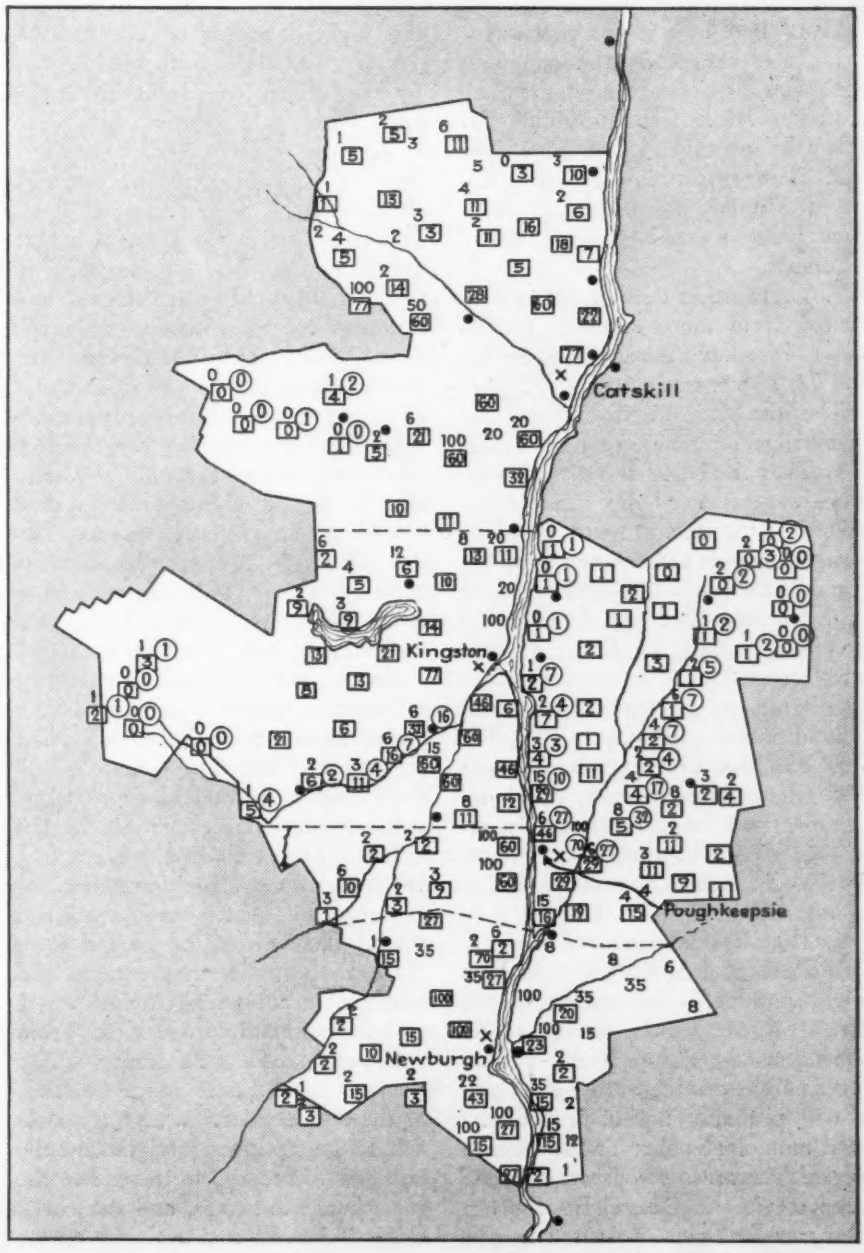
FIG. 2—Comparative data for three frequencies, 72.18 mc., 39.54 mc. (in circles for the same locations) and 31.02 mc. (in squares for other locations). Towns are shown by solid dots, transmitter locations by X and district limits by dash lines

ANTENNA ELEVATIONS (ft.)

Location	Test Frequency (mc.) 31.02/39.54*	39.54	72.18
Catskill	310	430	430
Kingston	305	385	385
Poughkeepsie	165	410	410
Newburgh*	320	——	405

RECENT ACTION of the Federal Communications Commission in promulgating less restrictive regulations for use of radio channels by electric and other utilities was founded upon thorough study and comprehensive recommendations by a joint industry committee, embraced in the Radio Technical Planning Board, as committee 4 of Panel 13. That committee had for its guidance the experience of companies that had been operating radio systems for many years under special emergency licenses, mostly in the 30-40 mc. band.

Growing congestion in that band was a major reason for the opening of two higher megacycle bands to utilities. The practicality of the 72-76 mc. band in particular is established by the tests reported in the accompanying article. The author was a leader in the program and his company's area has been a primary proving ground.—*The Editors*



the 535 taken in over 1,000 miles of road coverage. In general the coverage, although not satisfactory, was about as anticipated considering the low antenna elevations and the high noise levels at the fixed stations. In several vital remote locations the signal did not override local noise at the mobile unit. On the other hand, there were three major instances where a usable signal was received directly behind extensive ridges of 1,000 ft. or more in elevation. Similar results have been reported in many other tests and these merely confirmed the belief that reflection opportunities in mountainous regions may provide satisfactory and unpredictable communication paths.

Preliminary Conclusions

From these tests it was concluded:

1. That, except in the comparatively small Newburgh area, the fixed station locations were unsuitable for adequate coverage even at 30/40 mc.

2. That certain remote areas—Millerton, Hunter and the upper Rondout valley—would require special treatment.

3. That further tests should be conducted from more suitable (radiowise) locations using both 30/40- and 72/76-mc. equipment.

The decision to investigate the higher band was based on the belief:

1. That the character of the territory—as evidenced by unusual results on 30/40 mc. at many locations—might permit satisfactory coverage at points far below line-of-sight paths.

2. That the 72/76-mc. band would provide comparative freedom from interference known to be serious on 30/40 mc. as a result of extended ground waves and skip.

3. That this advantage would more than offset the somewhat lower signal to noise ratio resulting from the restricted deviation ratio required by the 40-kc. separation specified at 72/76 mc.

4. That less difficulty in local coordination of frequency assignments might reasonably be anticipated in the 72/76-mc. band. There are no allocations to the common carrier rural mobile service in this band and it will probably not be utilized by local municipal police or fire departments. The areas of operation of the latter services in Central Hudson territory are sufficiently limited to permit the use of 152-162 mc. channels at such time as obsolescence requires major replacements of their present 30/40-mc. equipment.

Final Tests

Results from some supplementary tests led to the choice of four locations near the local office but at substantially higher elevation than for the initial tests. Antenna locations, heights, elevations and noise levels were as follows:

Division	Location	Height (ft.)	Elev. (ft.)	Noise (Microvolts)
Catskill	Eastgate Hill	80	440	0.2
Kingston	Hillcrest Ave.	65	385	0.3
Poughkeepsie	Beck's Hill	45	415	0.2
Newburgh	Marne Avenue	55	395	0.4

Link equipment was used throughout these tests. Two 50-watt, station type units were mounted in a truck and supplied over a temporary 120-volt service cable run to the hilltops. To insure identical conditions at the fixed station, the two antennas were mounted at opposite ends of a short piece of pipe supported by bearings attached to a steel mounting plate. The assembly, in the form of a half swastika with a short center section, was then adjusted so that the antenna tips were the same distance from the center shaft. This contrivance was then mounted on top a pipe mast and arranged so that by operating ropes from the ground the arrangement could be rotated through 180 deg. and back and either antenna thus placed and held in a vertical position, the other one resting alongside the supporting mast, well out of the field. A circular radiation pattern was thus assured on both frequencies.

For the mobile installation the two sets were mounted in one truck completely independent of each other, and arranged so that the antenna not in use could be quickly removed.

Since the primary object of the tests was to determine whether or not 72.18 mc. would provide satisfactory coverage, the routes were planned to permit 72.18 mc. to be used along a route radiating from the main station until a point was reached where marginal operation occurred. From that point out to the limits of the territory careful note was to be made of the test locations, a time schedule was to be arranged and the mobile unit was to proceed to the end of the run, change antennas, and start back using 39.54 mc. and testing from the same locations used before. To eliminate the effect of standing wave patterns, every test was to be made with the mobile unit in motion and with the field strength reading at the fixed location mentally averaged while the mobile unit traversed a distance of not less than 250 ft. In most instances this procedure placed the body of the truck between the mobile antenna and the fixed station with the result that the 39.54-mc. field strengths were usually noticeably above the average of readings taken while traveling in opposite directions across any given test location.

Results Obtained

In more than 2,000 miles of car travel nearly 600 tests were made. Comparison of these data confirmed the preliminary conclusions.

In tests at two locations, Catskill and Kingston, the effects of (1) antenna height and (2) trees and foliage upon signal strengths were brought out rather sharply. In the Catskill test a small hill was located about ¼ mile north of the antenna whose tip was roughly 100 ft. below the crest of the hill. Several miles to the north where there were no mountains to act as reflectors, the cut-off behind the hill was found to be quite sharp on 72.18 mc., much sharper in fact than was noted behind larger hills located several miles to the west of the fixed station where nothing obstructed the line of sight for the first 3 to 5 miles. Raising the antenna some 50 ft. brought a very great increase in signal strength behind the close-in hill to the north but no change back of the more distant hills to the west.

At Kingston somewhat the same effect was noted except that there the fixed antenna was approximately 10 ft. above the average ground level of a flat plateau just to the south. This elevation placed it below the tops of the many trees thereabout and it was not until the antenna mast was raised 30 ft. to the top of a pole that satisfactory signal strengths were received to the south, the ratio being roughly 3 to 1 in several locations. As well as could be determined, the trees constituted the only obstruction in that direction. The change made no difference in signal strengths to the north where the line of sight was clear for 5 miles minimum.

In both cases the before/after vari-

ations in field strength on 39.54 mc. were considerably less than that experienced on 72.18 mc.

In several instances unusual results were obtained in mountainous territory where usable to satisfactory communication was unexpectedly obtained. As a matter of interest, five such instances have been plotted on Fig. 3 where the profiles and distances shown are along a straight line between transmitter and receiver (plotted from U.S.G.S. Quadrangles) and not along the route followed by the mobile unit. In considering these it should be remembered that there were many more similar locations where no communication whatever on either frequency could be obtained. The cases presented, therefore, simply illustrate the fact that beyond line of sight, performance is unpredictable and must be determined by actual field tests.

Further Deductions

As a result it has been concluded:

1. That with an output power ratio of 5:3 in favor of the 72.18 mc. mobile unit, higher frequency will:

a. Provide higher signal strength over short ranges. (0-10 miles)

b. Provide essentially equivalent signal strength over medium ranges. (10-20 miles).

c. Provide less signal strength and somewhat poorer coverage at ranges beyond 20 miles.

2. That mountainous territory provides frequent opportunity for usable to satisfactory communication over paths which are both unusual and unpredictable.

3. That the successful performance of any system is vitally dependent upon the selection of fixed transmitter locations which provide;

a. Adequate heights.

b. Minimum noise levels.

c. Clear sight paths for 2 miles or more in all directions.

None of these conclusions are new, startling or in conflict with accepted theory. However, too little attention appears to have been given to the importance of securing an unobstructed path near the fixed antenna.

72 Mc. Satisfactory

Although these findings may be of general interest, the more important result to Central Hudson was that the higher frequency did provide satisfactory communication over most of the company's franchise territory. Study of a complete plot of all data on a large scale map led to the conclusion that for the test locations chosen, a 72/76 channel would with few exceptions provide satisfactory communication over a 20-mile radius.

Analysis of the number of customers served by the company in the area covered by 20-mile radius circles centered on each transmitter, indicated that better than 85 percent are included in the area reached by more than one transmitter and that only 2½ percent lie outside the 20-mile circles of all transmitters. Although this coverage was deemed satisfactory, it was recognized that the field strengths produced in the ring lying between the 15 and 20-mile limits were in many cases uncomfortably close to an acceptable minimum. In planning the final system, an effort was accordingly made to choose permanent locations at higher elevations and closer to the geographic center of the division than were the test points. Furthermore, a comparatively low—74-ft.—antenna height was decided upon in order to avoid so far as possible any marking or lighting requirements of the CAA.

Pattern of Final Plan

As finally planned the system will consist of four main and four emergency stations.

Each main station will be normally supplied at 120 volts a.c. but will be equipped with a 32-volt storage battery, trickle charger, and rotary converter which will provide six to ten hours' independent operation.

Each main station will normally be controlled over a telephone circuit. To prevent extended disruption of radio service following possible failure of the telephone circuit, it is planned to base a 50-watt, portable station at each of the control points which are in division headquarters.

Field tests have shown that a portable transmitter at any one of the headquarters can readily communicate both with mobile units operating in the most highly populated part of its own division and with the main transmitter in the adjacent division. That transmitter in turn is expected to be able to reach the major portion of the territory deprived of radio service by telephone line failure. Should

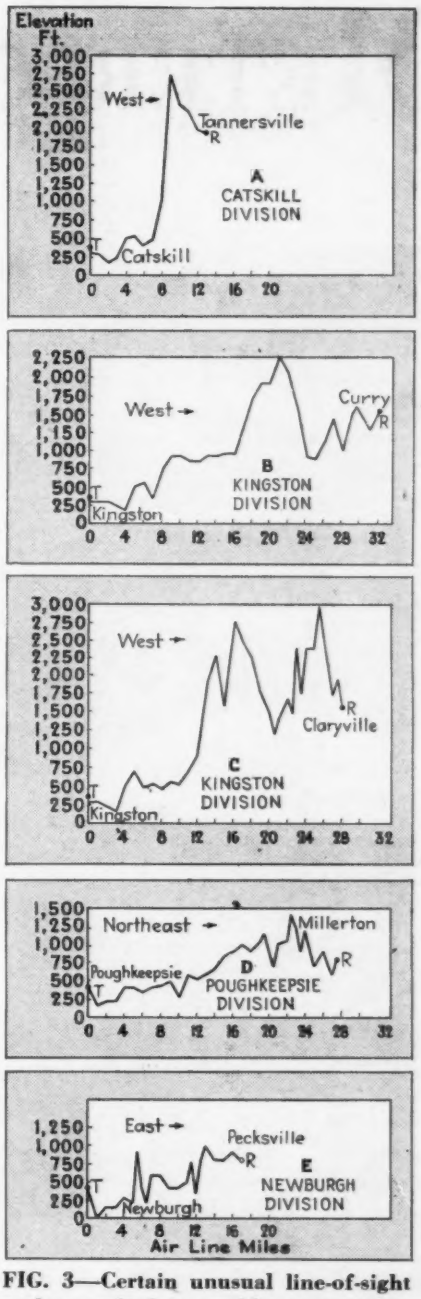
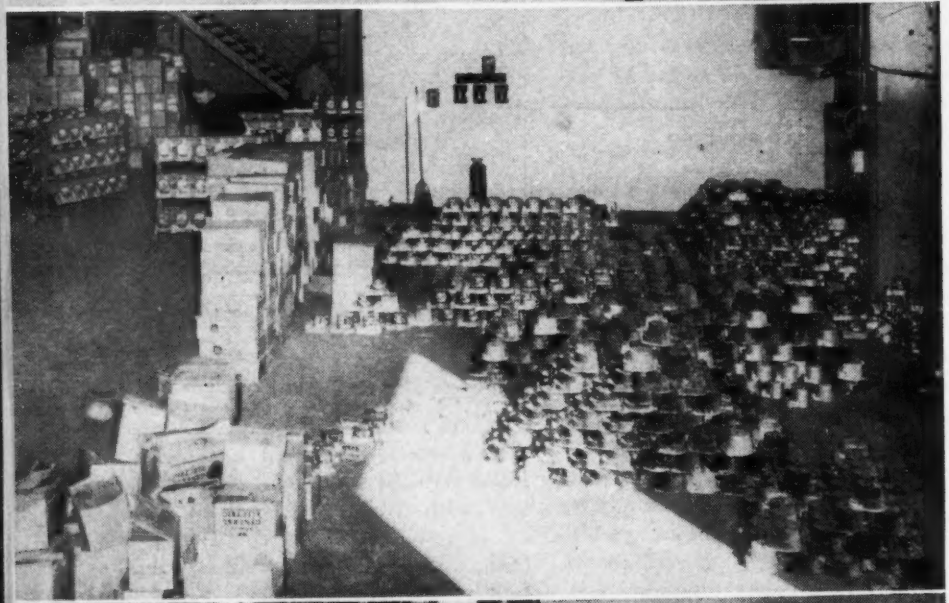


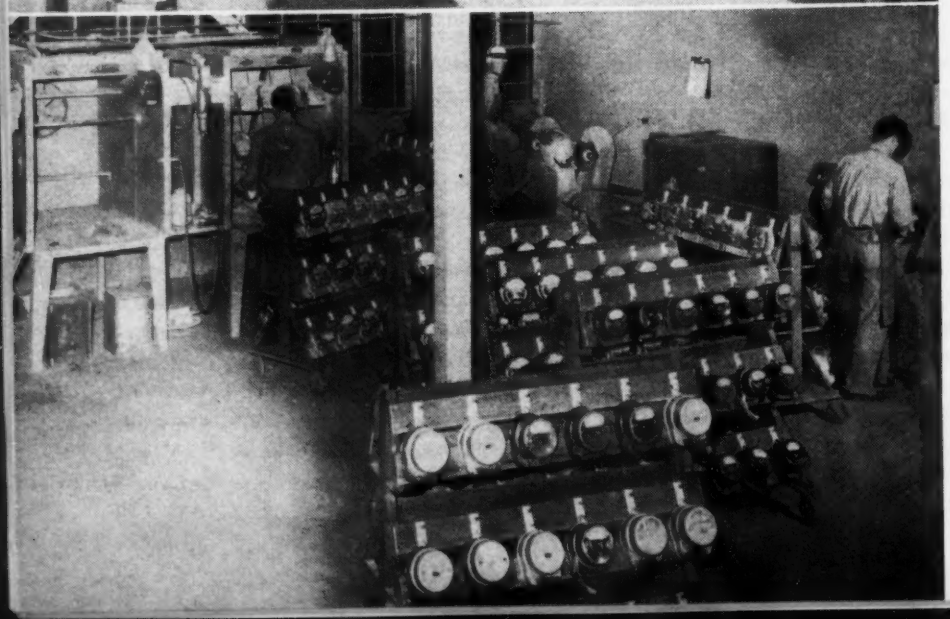
FIG. 3—Certain unusual line-of-sight paths resulted in usable communication with 72.18 mc. and 50 watts

both possibilities prove inadequate, full service can be quickly restored by sending an operator to the main transmitter and having him operate it as a manual relay station, the portable unit at headquarters then becoming the main transmitter.

The author wishes to acknowledge the assistance rendered by the General Electric Co. and the F. M. Link Co. in furnishing equipment to make the tests and the invaluable help, advice and time freely given by their representatives, R. G. Beyer of G.E. and Messrs. Roche and Bellingham of Link, in arranging for and assisting in the conduct of the tests.

METER CALIBRATION *for a*





AN IMPORTANT PHASE of the frequency change program currently being undertaken by the Southern California Edison Co. is the reconditioning and relagging (50 to 60 cycles) of half a million watthour meters within a period of approximately two and a half years. With present facilities taxed to the limit by normal system requirements it has been necessary to set up a separate and complete meter shop for the frequency change program. This shop and some of its important features are shown in the accompanying pictorial presentation.

Shop Procedure

The 50-cycle meters removed in the field are sent to the meter shop where, in the receiving room shown, they are sorted by type and rating and placed on the mobile meter racks which provide the means for transporting the meters through the entire flow line. The meters pass first through a section where they are cleaned by motor-driven wire brushes, spray painted, glass covers cleaned, etc. Next they progress through the repair section where new jewels and bearings are installed, registers are cleaned, and any necessary repairs are made. An approximate adjustment in the calibration of the meters at 50 percent power factor is made at the repair bench. This adjustment is simply the average change required for the type meter involved and serves to minimize the amount of adjusting necessary in the testing operations which follow subsequently.

REPAIR SHOP—here meters receive new jewels and bearings, (top left) registers are cleaned and any necessary repairs are made

RECEVING ROOM—meters come in from divisions at rate of 600 per day

CLEANING SECTION — after thorough cleaning meters are spray painted and made ready for repair shop

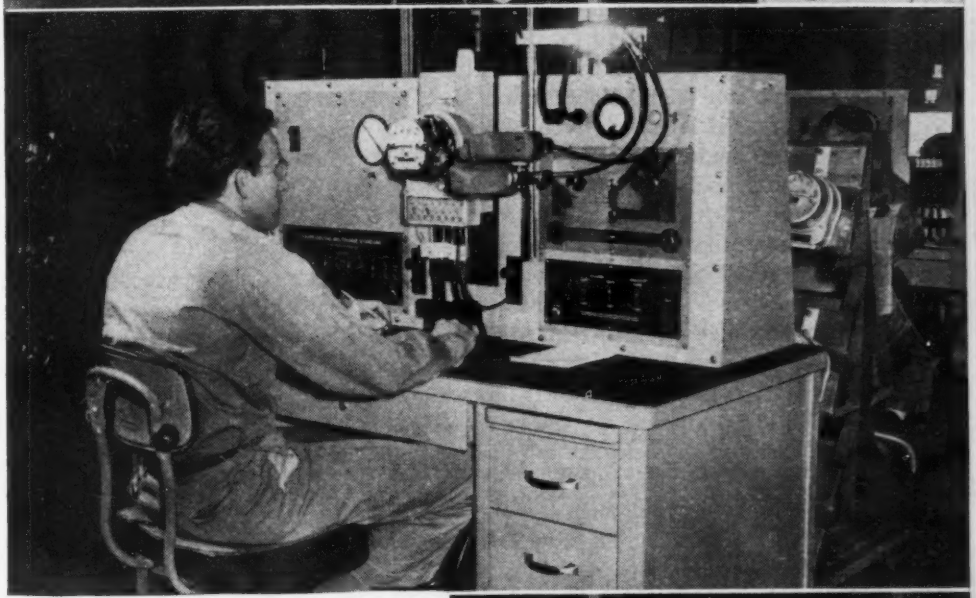
System-Wide Frequency Change

The testing section is equipped with sixteen Type TE-5 Knopp meter testing equipments built to Edison company specifications by Electrical Facilities Inc. of Oakland, Calif. This desk-mounted test board is designed to test accurately and rapidly all types of single-phase and polyphase meters at voltages of 120, 240 and 480, and at any current rating up to 50 amp. Inherent errors in the equipment are reduced to a minimum by operating the rotating standard at full load (5 amp.) and rated voltage (120 volts) regardless of the loading conditions for the meter under test. This is accomplished through the use of Knopp Uniload precision current and potential transformers.

Photo-electric Test Units

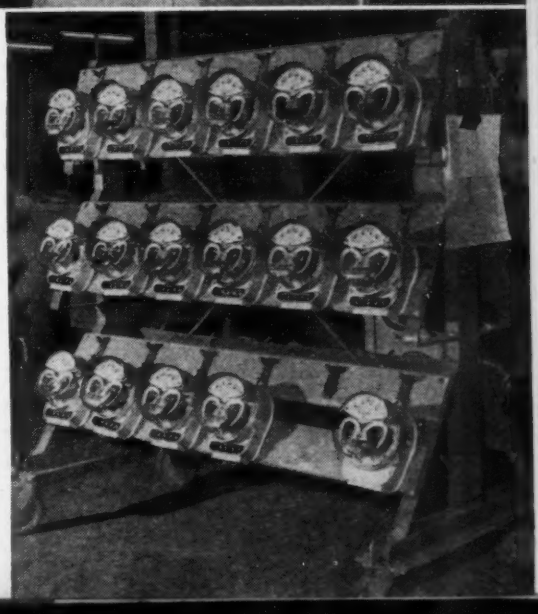
Personal error is eliminated by the use of a General Electric photoelectric testing unit which is built into each test board. Features of the equipment which make for higher production rates are (1) universal adapters which enable all types of meters to be rapidly connected and disconnected, (2) telephone type toggle switches and magnetic contactors for ease and speed of control, and (3) provision for testing three-wire meters without opening meter potential links. Other noteworthy features are provisions for the checking of balance between current coils of three-wire meters, and the application of a 1,000-volt, high-potential test by depressing two buttons, one with each hand, with leakage shown on a milliammeter. Two buttons were specified so that both hands would be engaged, thus eliminating any personal hazard to the meter tester.

On a two-shift basis, production at a rate of over 600 meters per day can be accomplished. When the frequency change project has been completed, many of the new test boards and much other equipment will be used to modernize the meter testing and handling facilities of the company's regular Shop and Test Division, it is reported.



TEST DEPARTMENT — speed and accuracy are attained with 16 new-type test boards (top) incorporating advanced features

DESK-MOUNTED TEST EQUIPMENT —features of these boards, built to Edison specifications, include Uniload precision instrument transformers, photoelectric timing, universal adapters, telephone-type switching and provision for testing three-wire meters without opening potential links



MOBILE meter racks transport meters through entire flow-line

Distribution System Economics For Light Load Density Areas...I

Possible solutions are adoption of higher voltage for primaries, smaller conductors, fewer substations, fault selective relaying to coordinate branch fuses with feeder breakers

O. B. FALLS, JR., *Power Distribution Division, General Electric Co.*

LIGHT LOAD density areas accentuate the factor of ratio of revenue to investment and therefore they bring into particular focus the issue of achieving minimum distribution investment consistent with rendering adequate and acceptable service. In such areas it is especially incumbent upon the engineer to base his choice of system upon components that can each be justified on their ability to earn upon the investment devoted to them.

It will be shown that resort to higher voltage circuits, fault selective relaying, automatic reclosure, regulators and capacitors properly correlated can contribute to the desired end. Automatic reclosure applied to the feeder circuits can reduce the number of fuse blowings and interruptions, thus reducing service trips and improving service reliability with bettered revenue and lessened dissatisfaction. Regulators allow more load to be carried on existing circuits with relatively small added investment or allow deferment of new lines or reinforcement of existing lines. Capacitors likewise offer opportunity to earn favorable returns on the investment in them.

Higher Voltage Primaries

When considering areas of light load density, the distances involved are such that the lower voltages, such as 4 kv., commonly used for urban work, become entirely inadequate in many cases. Thus, more and more frequently the question is raised as to whether or not the use of some higher voltage, such as 12.5 kv. or 13.8 kv., would produce a lower cost system for distribution.

When considering the use of higher distribution voltages, there are two basic factors to be considered. These are (1) the cost-factor, which includes both system investment and operating costs, and (2) such operating factors as service reliability, safety, working lines energized, tree trimming, joint use with telephone circuits, radio interference, etc. The cost factors are usually susceptible of calculation and may be determined sufficiently accurately before any general decisions are made, whereas the operating factors are mainly intangible and decisions can generally be made only based on experience.

Cost Factors

The highest voltage possible should be selected consistent with reasonable cost, safety and operating procedures. As for selecting a particular voltage level, there is one cost-factor which, frequently, is not given due consideration. That factor is one of obtaining lower equipment costs due to quantity production. The general trend is for costs per unit to decrease as the quantity manufactured increases. Thus, if higher voltages are to be used, it is preferable that one level be accepted, insofar as possible. Then, at least as far as the transformers are concerned, requirements can be limited to a minimum number of ratings and the lowest possible costs obtained.

To date, it appears that the use of voltages above the 15-kv. class for general distribution work, whether urban or rural, will result in costs higher than can be justified. This is due, partially at least, to the excessive cost of distribution transformers and protective equipment. In the 15-kv. class, which includes such voltages as 11,000, 12,000, 12,470, 13,200, and 13,800 volts, the multigrounded neutral system will give the lower cost because the equipment for line-to-neutral connection costs less than for line-to-line connection. Then too, less protective equipment in the form of cutouts and arresters is required. Of the voltages just named, the 7,200/12,470-wye system seems to be most popular at present and, therefore, on future construction, warrants serious consideration as compared to the other voltages.

Smaller Conductors

Use of higher primary voltages can result in decreased investment through a reduction in conductor size, number of feeder positions and primary energy losses and improved voltage regulation and load capacity for the system.

These advantages are interrelated to a certain extent and may or may not

all be obtained simultaneously, depending on specific designs. For example, for the same percent voltage drop, primary energy loss and conductor size, a 12-kv. system will carry 9 times the load of a 4-kv. system. On the other hand, assuming the same conductor size and load, the percent voltage drop and energy loss of the 12-kv. system will be 1/9 of that of the 4-kv. system. Of course, if desired, the conductor size, percent voltage drop, energy loss and system capacity can all be improved in a lesser proportion. These cost advantages are partially offset by the fact that the distribution transformers, protective equipment and line insulation will cost more.

Fewer Substations

Another cost-factor favoring the use of the higher voltages is the possibility of eliminating transforming substations or at least reducing the number of them with the higher voltage. For example, in some cases, the generator voltage may be 12 kv. or 13.2 kv. serving distribution substations direct at this voltage. In other cases, the generator voltage may be at a lower level but the higher voltage system may have been established for a subtransmission system.

The greatest initial economy is generally obtainable when the higher voltage system is already available for other reasons, since this means complete elimination of transforming substations. There will be situations, however, involving step-down substations from some still higher transmission voltage to the primary voltage, where it will be possible to show savings in over-all costs for the higher distribution voltage. The chief savings in this case, therefore, must necessarily be found in the primary circuits although there may be some savings in substation costs because of fewer circuits and possible elimination or reduction of individual circuit voltage regulators.

Operating Factors

Among operating factors to be considered when resorting to higher voltage primaries are:

1. Live-line maintenance.
2. Tree-trimming (which can be averted by use of aerial cable).
3. Joint use with communication circuits (which can usually be solved satisfactorily).
4. System simplification by reduction of number of circuits and possibly number of substations.
5. Service reliability (which can be as good or better than now obtained on many lower voltage circuits).

More Load, Greater Distance

The latter point is in keeping with the trend which has resulted from an effort to dispel the earlier idea that poorer service has often accompanied the adoption of higher voltages for primaries. But higher voltage is not likely to be justified unless the circuits are allowed to carry more load or cover more distance than the lower voltage circuits.

In general, the carrying of greater load per circuit means that unless some method of circuit sectionalizing is used, probably a larger number of customers will be out for any given fault condition. If more distance is covered the exposure to fault conditions increases and, therefore, more outages per customer may be experienced.

The development of better protective devices and methods of protection has changed this picture somewhat. Theoretically, it can probably be shown that by the use of such devices and methods, the customer-minutes-outage will not be increased over what has been obtained in the past with the lower voltage systems. From a practical standpoint, however, sufficient operating data has not been accumulated on which to base any general conclusions.

Fault Selective Relaying

Fault selective relaying provides instantaneous first opening and time-delay successive openings in event of a fault on the feeder. The object is to render the feeder circuit breaker *faster* than any branch circuit fuse on the first opening and *slower* than any branch circuit fuse on successive openings.

With such a system, the feeder breaker can handle all non-persistent faults within its orbit, even those beyond branch fuses, but if a fault beyond a branch fuse is persistent, the branch fuse will blow before the feeder breaker opens a second time.

This system permits the reclosing breaker to provide reclosing service to the entire feeder and thus virtually eliminate service trips on transient faults. It permits the branch fuses to isolate only permanently faulted branches without disturbing service to any other part of the feeder.

Since, on the initial tripping of the circuit breaker, the total clearing time of the breaker must be short enough that branch fuses will not be damaged, it is necessary to have a fast circuit breaker. A modern 8-cycle breaker is usually satisfactory. Thus, allowing 1 cycle for relaying time, the 8-cycle breaker can clear the circuit in 9 cycles.

The time-overcurrent relay characteristic should be "very inverse" rather than "inverse" since the "very inverse" more closely approaches the fuse characteristics and, thereby, provides more flexibility in the fuse coordination setup.

Adaptability to Feeders

Fault selective protection lends itself best to use on grounded-wye connected feeders because the instantaneous trip can be used in the ground relay which can usually be set to trip at a much lower value of current than can the phase relays. Most of the faults beyond fuses on a grounded-wye circuit will be line-to-ground faults so that the low setting of the ground relay is a real benefit in permitting fault selective protection to reach out to the ends of the line and the branch taps.

Feeders with a nominal rating 12 or 13 kv. lend themselves better to fault selective protection than do 4-kv. feeders because, with the higher voltage, the line fault current holds up better with distance.

This type of protection has found the widest acceptance in the western, central, and southern parts of the country where feeders tend to be longer and more exposed to lightning than in the northeastern part of the country. Its use is growing because of the improved service continuity and reduced operating expense it provides at a low cost.

Quality of Service

Quality of service includes voltage conditions as well as continuity of service. In connection with voltage conditions, the use of either or both regulators and capacitors can help to improve voltage conditions as well as reduce system investment. This issue will be discussed in an ensuing instalment.

DEMAND CONTROL *Through Supervision*

Load factor increased from 55 percent to 75 percent. . . . Annual saving in power cost eight percent . . . No loss in production . . .Demands of plant divisions transmitted to control division to govern operation

E. G. SCHLUP, *Electrical Engineer, Middletown, Ohio*

CONTROL of power demand in an industrial plant of several divisions can be made effective if the division supervisors have information from other divisions as well as their own, and so can govern their operations to fit into the general pattern. The key to control is transmission and recording of demands in the divisions and in the total plant.

A successful installation for such a plan has been in operation through the war years without adversely affecting record production. Power demands and the types of operation vary widely between the five main divisions of the plant. Experience has shown that the essential cooperation among supervisors is not difficult after the system is properly understood and the benefits in power costs are appreciated. The load factor for the plant was raised from 55 percent to 75 percent, with a saving of 8 percent in power cost, and other benefits in operation were also realized.

Transmitters and recording instruments use standard equipment in a specially developed arrangement for this purpose. Recorders are located in each division, and recorders for all

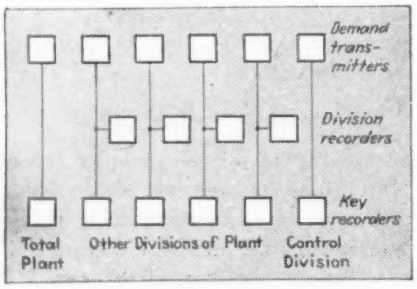


FIG. 1—Demand transmitters and recorders in all plant divisions are arranged to show supervisors load situation at all points

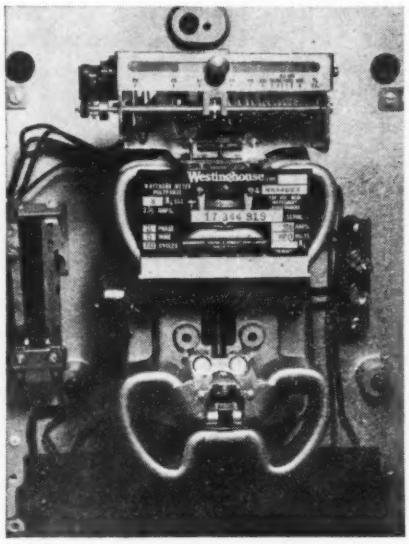


FIG. 3—Demand impulse transmitter with adjustment bar above a standard meter unit. An auxiliary relay to send impulses to the recorder is at the left

divisions as well as the total plant demand are centered in the division with the highest power demand and the most effective demand control possibility (Fig. 1).

Power peaks are caused by spurting of production of all divisions of a plant at the same time. A study of demand curves revealed the consistency of such peaks at the beginning or the end of work turns. Load-duration curves, as in Fig. 2 (a) for the total plant, showed the short total time of the maximum demand during one month. The demands are plotted against total time, which is the total of combined 15-min. periods for the demand range. Fig. 2 (b) shows the same data for the largest division.

This divisional load chart brought out the fact that if 10,200 kw. would be allocated to the division it would operate at this rate for 45 hours out of a total time of 744 hours in the month. A demand rate of 11,400 kw. was required for a total of ten hours and 12,600 kw. for a total of only two hours. The times of ten hours and two hours are not consecutively measured time periods but are accumulated 15-min. periods which also include "off-peak" power periods during the night and over week ends.

Demand control during "off-peak" periods is not essential from the standpoint of cost of power, and this divi-

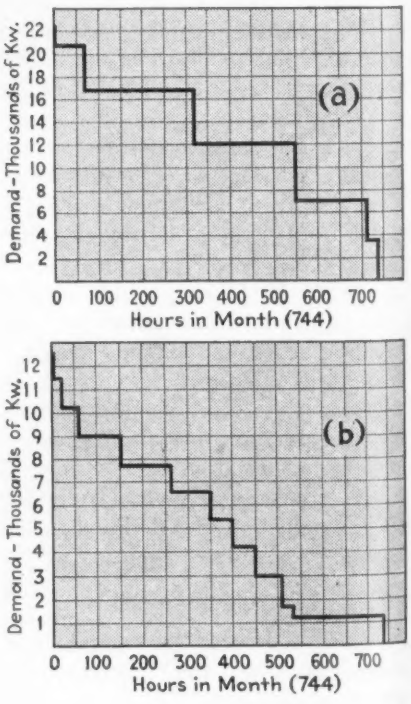


FIG. 2—Demand in thousands of kw.-hr. per hour (kw. times 1,000) shows the short total duration of peaks during the month. Curve (a) is for the total plant and (b) for the largest division

sion also can operate in excess of 10,200 kw. during on-peak periods if some other division is below its allocation of demand during any of the measured power periods. The division supervisor is informed of this condition by other division recorders and the total plant recorder.

If the total plant demand exceeds the allocated demand during any measured time interval, alarm devices inform the operator and he advises the supervisor of the division exceeding its demand allocation. The demand control has improved uniformity of plant production, reduced safety hazards and the overloading of equipment and plant facilities. Combined with automatic power factor control (ELECTRICAL WORLD, September 21, 1940), it has improved voltage and loading of circuits for the best utilization of power.

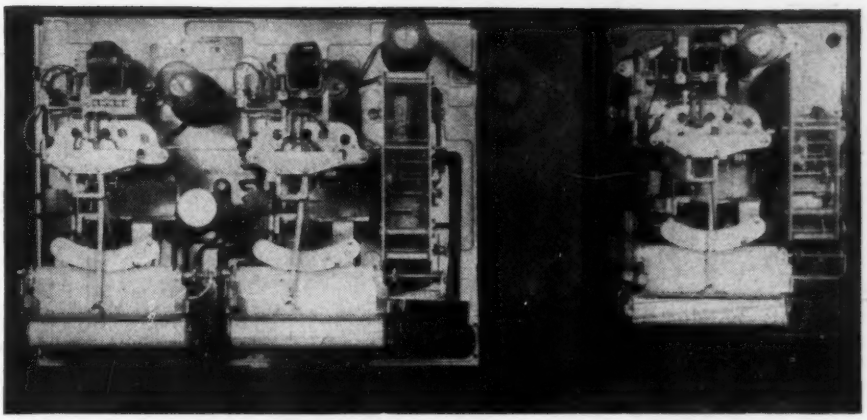


FIG. 4—Group of recording instruments. Actual demand is plotted on a chart as percentage of allocated demand. A constant speed pointer indicates time interval and "ideal" use of demand

The demand transmitter (Fig. 3) is of the variable impulse type driven by a standard two-element watthour meter unit. The recorder (Fig. 4) is of the dual type to indicate both allocated and actual load. Impulses are sent over a three-wire connection from the transmitter to operate a rocker arm with escapement at the recorder. Frequency of the impulses is determined by the position of a sliding adjustment gear connected to the meter shaft and driving a five-segment commutator (Fig. 5).

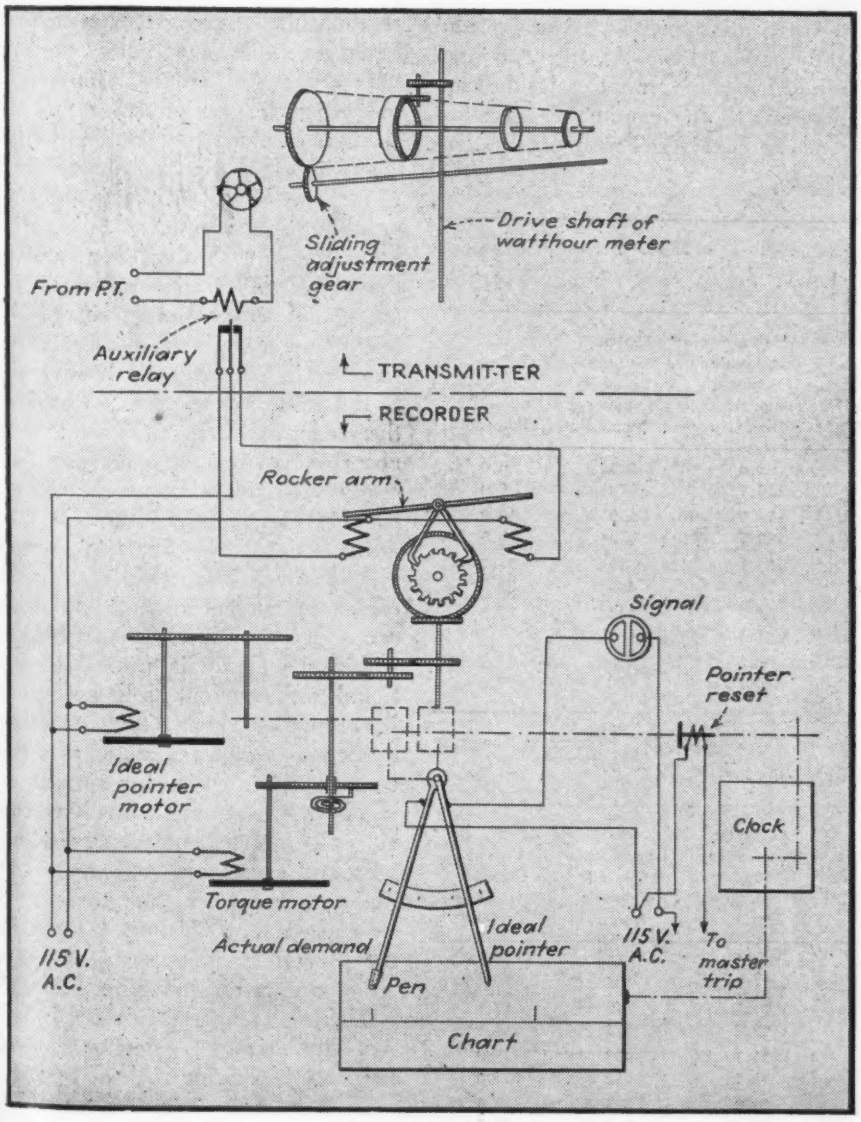


FIG. 5—Impulses sent over three-wire connection from transmitter to the demand impulse recorder. Each impulse operates rocker arm with escapement and crown gear wheel. Second painter to indicate "ideal" condition

The sliding gear is set at the maximum allocated demand with respect to the total capable of being registered by the meter. Power demands are allocated as a percent allowance rather than actual kw. of figures for easier interpretation by the division supervisors. On the recorder, 100 percent indication always shows the full use of allocated demand during the 15-min. interval of operation.

Actual demand is recorded on a chart and is indicated by the pointer which is operated by the rocker arm and escapement mechanism. Spring tension to the drive shaft is maintained by a torque motor. A constant speed motor drives a second pointer to indicate time elapsed as well as percent ideal demand for the period, shown by the relative position of the actual demand with respect to the "ideal" condition. If the actual demand pointer coincides with or leads the ideal pointer, contacts on the pointer arms close the circuit through a neon signal lamp.

Pointers of all the recording devices are shifted back to zero position, and the chart is rotated to a new position, by resetting solenoids energized at 15-min. intervals.

JOINTS and HARDWARE Limit

LEONARD M. OLMSTED, *Division*

TESTS conducted on splices and joints used for No. 4/0 hard-drawn bare stranded copper conductors for long-span construction were discussed in the preceding instalment. It indicated the de-ratings of conductor current capability required to avoid joint impairment by oxidation and several methods by which these de-ratings may be eliminated. Until the malleable iron conductor-supporting hardware is correspondingly improved, however, only part of the potential gain in current capability can be utilized in establishing operating ratings.

In long-span construction, the conductor usually is supported by strain clamps at dead ends and sharp angles, by suspension clamps at intervening structures. Both types of clamps commonly used are made of malleable iron with the conductor secured by means of steel J-bolts or U-bolts. These ferrous parts form one or more complete paths of magnetic material surrounding the conductor which are exposed to magnetization by the flow of current in the conductor. Such magnetization causes hysteresis and eddy current losses of sufficient magnitude* in some cases to raise the temperature of the conductor, therefore must be considered as a possible restriction to the current capability of the circuit.

Tests on the several types of malleable iron clamps used by the Duquesne Light Co. show that all the suspension clamps cause increased conductor temperatures throughout the range of current capability of the complete paths of magnetic material No. 4/0 conductor, in some cases by more than 30 deg. C. The increase in temperature does not show a simple relationship to the conductor current, being a complex function of the hysteresis and eddy-current characteristics of the ferrous materials and the relation of magnetic heating in the clamp to the dissipating ability of its exterior surface. At low values of current, the magnetic heating varies approximately as the 1.9 power of the current. As the current is increased, however, saturation of the magnetic material causes a less rapid increase in the magnetic heating until the point is reached beyond which the clamp functions as a radiator to absorb heat from the conductor, generally at currents above the current capability of the conductor.

Inspection of the test results plotted in Fig. 3 indicates that the decrease in current required to avoid excessive conductor temperature within the clamp is nearly proportional to the current itself throughout the range of conductor capability, hence may be approximated as a percentage of the conductor current capability. The strain clamps have considerably greater surface to dissipate heat and cause less increase in conductor temperature than the suspension clamps. De-rating factors for the several types of suspension and strain clamps are shown in Table VI.

These tests were conducted in still air. Analysis of the factors controlling the dissipation of heat from the conductor and clamp indicates that

TABLE IV—Normal Operating Ratings of No. 4/0 HDB Stranded Copper Conductor Restricted by Joints

	Average Decrease in Temp. Rise from Table III Percent	Maximum Permissible Conductor Temp. Rise, Deg. C	Current Capability on No. 4/0 Conductor Amp.	Loss of Current Capability Percent
Tarnished No. 4/0 Conductor, Summer	0.0	92.0	505	0.0
Winter	0.0	115.7	570	0.0
Twisted sleeve splice, Summer	38.8	73.5	450	10.9
Winter	38.8	92.7	510	10.5
Automatic splice, Summer	19.8	56.1	395	21.7
Winter	19.8	70.7	445	21.9
Parallel groove connector, Summer	35.0	69.2	440	12.8
Winter	35.0	87.4	495	13.1
Double U-bolt connector, Summer	28.0	62.5	415	17.8
Winter	28.0	78.7	470	17.5

TABLE V—Emergency Operating Ratings of No. 4/0 HDB Stranded Copper Conductor Restricted by Joints

	Average Decrease in Temp. Rise, from Table III Percent	Maximum Permissible Conductor Temp. Rise, Deg. C	Current Capability on No. 4/0 Conductor Amp.	Loss of Current Capability Percent
Tarnished No. 4/0 Conductor, Summer	0.0	106.0	615	0.0
Winter	0.0	131.7	685	0.0
Twisted sleeve splice, Summer	38.8	73.5	510	17.1
Winter	38.8	92.7	575	16.1
Automatic splice, Summer	19.8	56.1	450	26.9
Winter	19.8	70.7	500	27.0
Parallel groove connector, Summer	35.0	69.2	495	19.5
Winter	35.0	87.4	560	18.5
Double U-bolt connector, Summer	28.0	62.5	470	23.6
Winter	28.0	78.7	530	22.7

*Calculations indicate that magnetic losses may run as high as 200 watts per suspension clamp at currents within the thermal capability of No. 4/0 copper conductor.

Overhead Conductor Ratings . . . II

Engineer, Duquesne Light Co., Pittsburgh, Pa.

Magnetic effect of malleable iron conductor-supporting hardware accentuates heating of conductor — Some gains achieved by substitution of non-magnetic components—Safe conductor ratings set pending availability of propitious hardware

air movement has a proportional effect upon both, however, and these de-rating factors may be applied to conductors supported by malleable iron clamps in moving air. Applying the factors to the current capability of the No. 4/0, hard-drawn, bare, stranded copper conductor gives the current capabilities as restricted by hardware, shown in Table VII.

If greater current capabilities are required than the ferrous suspension clamps permit, then it appears practical to substitute sufficient non-ferrous parts to reduce the magnetic heating. The tests were extended, therefore, to various modifications of these clamps. The J-bolt clamps are greatly improved by substituting a non-ferrous keeper to prevent the flow of magnetic lines of force between the J-bolts. Magnetic heating is completely overcome by the additional substitution of bronze J-bolts, but it is questionable whether such bolts could provide adequate mechanical strength to hold the conductor properly. The larger J-bolt clamp inherently causes less temperature rise than the smaller one, and the addition of a layer of No. 6 copper armor rods over the No. 4/0 conductor to increase the radiating surface completely overcomes the effect of magnetic heating.

The U-bolt suspension clamps are improved but little by substituting a brass keeper, as the main magnetic paths are not changed. The additional substitution of bronze U-bolts completely overcomes the magnetic heating. Placing the larger U-bolt clamp over a layer of No. 6 copper armor rods reduces the effect of magnetic heating, but does not completely overcome it unless a non-magnetic keeper or non-magnetic U-bolts are added.

The strain clamps require but little de-rating below the current capabilities of the No. 4/0 copper conductor and no remedial measures are recommended as the possible advantage does not appear to justify the effort.

These results are compared in Fig. 4, from which it is apparent that the following methods are desirable.

1. Replace the ferrous keeper with non-ferrous in present small J-bolt suspension clamps.
2. Replace the ferrous U-bolts and

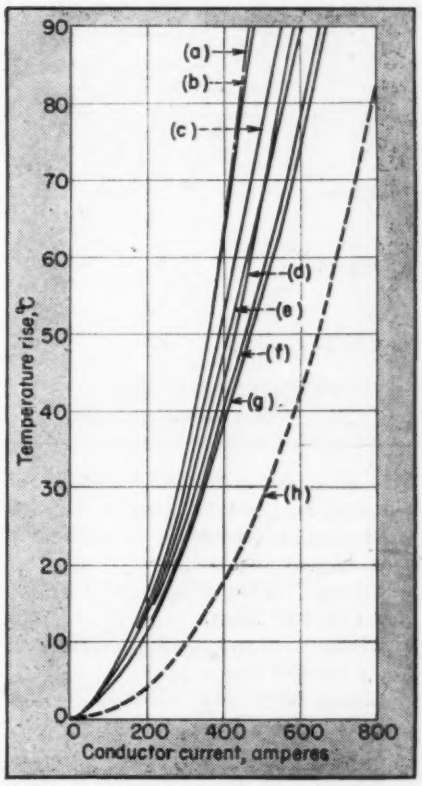


FIG. 3—Temperature rise of No. 4/0 HDB stranded copper conductor in malleable iron suspension and strain clamps in still air indoors
a. Suspension clamp with two U-bolts, No. 1 to 350 Mcm.
b. Suspension clamp with two J-bolts, No. 1 to 350 Mcm.
c. Suspension clamp with two J-bolts, 300 to 750 Mcm.
d. No. 4/0 conductor
e. Strain clamp with three U-bolts, No. 3/0 to 250 Mcm.
f. Strain clamp with four J-bolts, 300 to 950 Mcm.
g. Strain clamp with four J-bolts, No. 1/0 to 400 Mcm.
h. No. 4/0 conductor in 4¼ mph. crosswind

TABLE VI—De-rating Indicated by Tests on Six Clamps

No. 4/0 Conductor Temperature rise	Current De-rating Factors, Percent			
	30 C	60 C	90 C	AVERAGE
Suspension clamp, 2 U-bolts, for No. 1 to 350-Mcm. conductor	13.8	17.2	19.7	16.9
Suspension clamp, 2 J-bolts, for No. 1 to 350-Mcm. conductor	13.8	16.8	18.3	16.3
Suspension clamp, 2 J-bolts, for 300-Mcm. to 750-Mcm. conductor	8.3	8.3	6.0	7.5
Strain clamp, 3 U-bolts, for No. 3/0 to 250-Mcm. conductor	5.2	2.1	−3.0	1.4
Strain clamp, 4 J-bolts, for 300-Mcm. to 950-Mcm. conductor	−4.0	−8.7	−11.3	−8.0*
Strain clamp, 4 J-bolts, for No. 1/0 to 400-Mcm. conductor	−6.1	−11.7	−13.8	−10.5*

* *Indicates no de-rating required.*

keepers with non-ferrous in present small U-bolt suspension clamps.

3. Apply No. 6 copper armor rods to the conductor within present large J-bolt suspension clamps.

4. Apply No. 6 copper armor rods to the conductor and replace the ferrous keeper or U-bolts with non-ferrous in present large U-bolt suspension clamps.

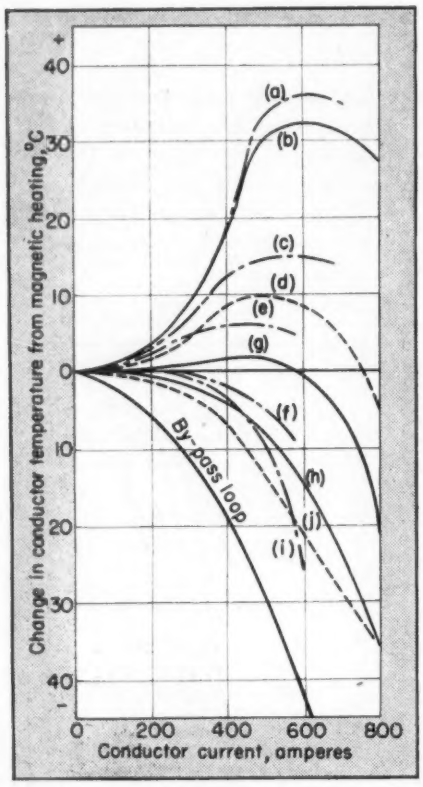


FIG. 4—Comparison of methods for reducing magnetic heating of No. 4/0 HDB copper conductor in malleable iron suspension clamps

a. Clamp with two U-bolts, all ferrous, No. 1 to 350 Mcm.

b. Clamp with two J-bolts, all ferrous, No. 1 to 350 Mcm.

c. Clamp with two U-bolts, ferrous except brass keeper, No. 1 to 350 Mcm.

d. Clamp with two J-bolts, all ferrous, 300 to 750 Mcm.

e. Clamp with two U-bolts, all ferrous, No. 4/0 to 750 Mcm. over No. 6 armor rods

f. Clamp with two U-bolts, ferrous except aluminum keeper, No. 4/0 to 750 Mcm. over No. 6 armor rods

g. Clamp with two J-bolts, ferrous except copper keeper, No. 1 to 350 Mcm.

h. Clamp with two J-bolts, brass keeper, bronze bolts, No. 1 to 350 Mcm.

i. Clamp with two U-bolts, brass keeper, bronze bolts, No. 1 to 350 Mcm.

j. Clamp with two J-bolts, all ferrous, 300 to 750 Mcm. over No. 6 armor rods

All methods but the first completely eliminate the necessity to de-rate the circuit because of magnetic heating, and the first leaves so little as to be negligible. An alternative method is to install a loop of conductor to bypass part of the current around the suspension clamp; this method is highly effective but limited in application because of the additional space required. For new construction, or where replacement of existing hardware is required for other reasons, then any of these combinations may be selected. The armor rod appears desirable, however, because of its advantage of mechanical protection to the conductor against arc burns.

By the methods described, it is possible to establish safe operating ratings

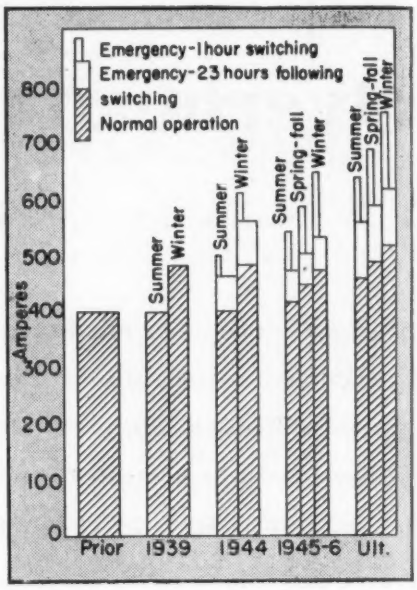


FIG. 5—Progress in rating No. 4/0 HDB stranded copper conductor for long-span circuit construction

TABLE VII—Current Capabilities of No. 4/0 HDB Stranded Copper Conductor Restricted by Malleable-Iron Clamps

	Suspension Clamps				Strain Clamps
	2 U-bolts No. 1/0 to 350 Mcm., Amp.	2 J-bolts No. 1 to 350 Mcm., Amp.	2 J-bolts 300 Mcm. to 750 Mcm., Amp.	3 U-bolts No. 3/0 to 250 Mcm., Amp.	4 J-bolts (1) No. 1/0 to 400 Mcm. (2) 300 to 950 Mcm., Amp.
Normal Operation					
Annual	445	450	495	525	535
Summer	420	425	465	500	505
Spring-Fall	450	450	500	530	540
Winter	475	475	525	560	570
Emergency 1-Hour Switching Time					
Annual	630	635	705	750	760
Summer	585	590	650	695	705
Spring-Fall	630	635	705	750	760
Winter	695	700	770	825	835
Emergency 23 Hours Following Switching					
Annual	540	545	600	640	650
Summer	510	515	570	605	615
Spring-Fall	540	545	600	640	650
Winter	570	575	635	675	685

TABLE VIII—Ampere Ratings for Existing No. 4/0 HDB Stranded Copper Circuits, Derived from Thermal Capabilities of Conductor De-rated for Joints and Hardware

	ANNUAL	SUMMER	SPRING-FALL	WINTER
Normal operation	440	415	445	470
Emergency 1-hour switching time	585	540	585	645
Emergency 23 hours following switching	500	470	500	530

TABLE IX—Ultimate Ampere Ratings for No. 4/0 HDB Stranded Copper Circuits After Joints and Hardware De-ratings Have Been Eliminated, Limited to 90% of Conductor Thermal Capabilities

	ANNUAL	SUMMER	SPRING-FALL	WINTER
Normal operation	480	455	485	515
Emergency 1-hour switching time	685	635	685	750
Emergency 23 hours following switching	585	555	585	615

ings for hard-drawn bare copper conductors in long-span construction. Determination of the thermal capability of the conductor is not new, but obviously does not by itself establish safe ratings. Even though the circuit may have adequate joints and nonheating hardware, conductors installed overhead are exposed to occasional arc burning and other damage such that its size may be somewhat decreased at points generally unknown to operating personnel. Sound engineering demands some margin for such conditions and 10 percent does not seem excessive. Ultimate ratings for the conductor are thus established at 90 percent of the thermal capabilities, as listed in Table IX.

Existing circuits on the Duquesne Light system have joints which are inadequate for such ratings, however, and must be restricted to somewhat lower values. Fortunately these circuits had no automatic splices, consequently were capable of carrying currents up to the capability of the double U-bolt connectors; these have a de-rating factor of 17.5 to 17.8 percent under normal operation and 22.7 to 23.6 percent for emergency conditions. The existing joints thus establish maximum ratings of 82.4 percent of the conductor capability for normal operation and 76.2 percent for emergency conditions. The conductor-supporting hardware imposes slightly less de-rating, hence the ratings of Table VIII are allowable.

Fig. 5 shows the progress that has been made in rating No. 4/0 hard-drawn bare stranded copper conductor, and the increase that may still be secured when it becomes necessary to rebuild the joints and modify the supporting hardware to utilize the ultimate ratings of the conductor itself. Most of the gain is in the emergency ratings, but experience has shown that system capability usually is established by emergency ratings of certain components under equipment-out conditions. Operating conditions of the Duquesne Light system permit higher functional ratings with such an allocation of conductor capability than is possible otherwise.

It must be remembered, however, that such ratings involve conductor temperatures as high as 150 to 160 C. when carrying maximum emergency currents under most unfavorable atmospheric conditions. Such operating temperatures cause an appreciable increase in conductor sags; some circuits may be limited by ground clearances to currents below 90 percent of the capability of the conductor.

Hydroelectric Program for Manila

(McGraw-Hill World News Report)

The Manila area before the war was served by an American concern, the Manila Electric Railway and Light Co., known as Meralco, all of whose power supply sources were totally destroyed in the battle of the Philippines; for nine months after liberation Manila was plunged into total darkness, with power supply to essential services maintained by small Army-operated Diesel units.

A semblance of normal light service was not restored until toward the end of 1945 when the U. S. Army Engineer-operated, 30,000-kw., floating power plant *Impedance* arrived from the U. S. after 107 days at sea.

Meanwhile, the Caliraya dam of the National Power Corp. is beginning to look up with a definite promise to relieve the Army emergency plant this year. This plant at Lumban, Laguna Province, is within economic transmission distance from Manila. Construction was started in 1939 and was nearly completed when the Japanese took Luzon.

The project, as developed, provides for an initial capacity of 37,500 hp. in three units with a gross head of 886 to 928 ft. Water power is one of the natural resources which may not be exploited by foreigners after July 4 unless the Philippine constitution is amended to waive this provision. A constitutional revision protecting Americans against discrimination is sure to come as part of the deal under which the U. S. undertakes to continue free trade with the Philippines over a number of years and to give financial assistance in the rehabilitation of the Islands.

The National Power Corp. since its inception has compiled data and prepared preliminary reports on a total of 24 hydroelectric projects with an estimated aggregate output capacity of 850,000-kw., covering more than half the Islands' total hydro potential of 1,500,000 kw.

In addition, there are detailed plans and estimates for the 72,000,000-kw.-hr. Agno River Project No. 1 at Itogon, Benguet, on which work will be started at the earliest possible opportunity.

Philippine Hydroelectric Projects, Five-Year Power Rehabilitation Plan

PROJECTS	MIN. CU. METERS PER SEC.	DAM HEIGHT M.	DAM LENGTH M.	HEAD M.	GROSS OUTPUT* 90% UTLZN.	NO. OF UNITS	TURBINE HP. x1,000
Lumot River with 4th Unit, Caliraya	.....	27	2204	.....	50	1	12.5
Angat River	17.3	30	62	55.9	110	2	12.5
Camiling River	1.96	18	....	48	17	2	1.8
Penaranda Chute	2.36	..	....	7.12	4	1	0.8
Talavera Chute	0.84	..	....	15.10	3.6	2	0.4
Agno River (Itogon)	6.19	22.5	2520	65.5	72	2-3	8
Agno River (Ambuklao)	.....	.....	650	84.1	140	4	12.5
Amburayan Chute	7.88	.....	....	7.15	2.75	1	0.5
Gasgas River	0.9	6	1520	52	9.8	2	1
Bosigon River	3.5	20	3400	30	9.8	2	1.25
Barit River, 1st Stage	3.15	7.5	610	15	8.2	1	1.5
Cawayan River	0.49	.....	....	.....	2.65	1	0.65
Mantayupan River	0.06	7	240	115	3	2	0.3
Loboc River	7	13	226	23	14	2	1.5
Sibulan Falls	.....	5	950	282.5	34.5	1	6.4
Lauao No. 6 Maria Christiana	74.5	14.50–19.50	....	53–	780	2-4	73

* Millions of kw.-hr.

HOW

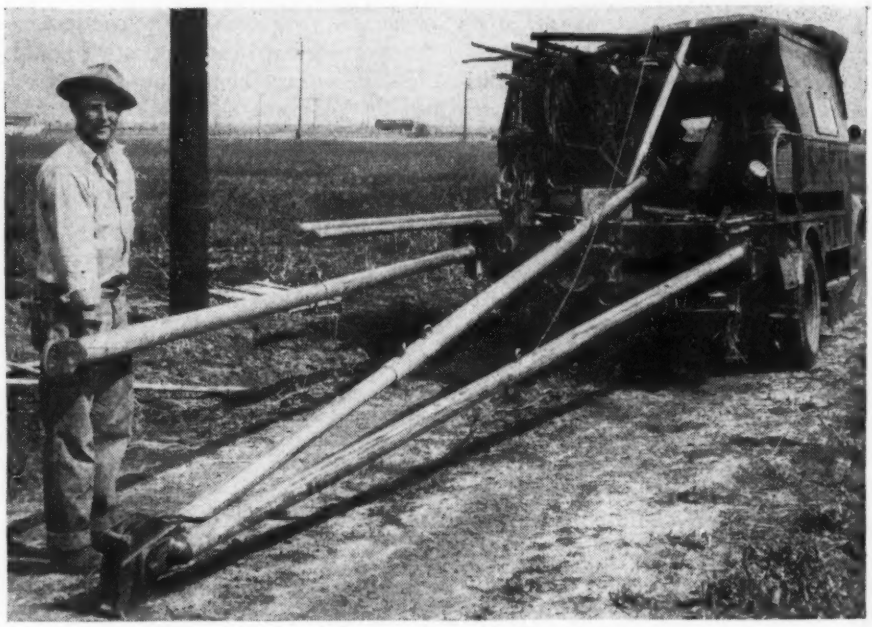
DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Aluminum Alloy Derrick Weighs ⅓ That of Steel

N. P. CARLSON
Pacific Gas and Electric Co.
San Francisco

WORKMEN of Pacific Gas and Electric Co. no longer have to fight the weight of heavy steel tube derricks on line trucks because of a ⅔ weight reduction made possible by the aluminum alloy derrick shown. Moreover, pay load of line trucks is increased by approximately 400 lb. Fifty such derricks are now in use and 37 more are under construction.

Two sizes of derricks are used, 22 ft. and 27 ft. Members of the "A" frame on the 22-ft. derrick are made of aluminum alloy tubing, 3½ in. O.D., and ¼ in. thick. On 27-ft. derricks, 4-in. tubing is used. Stiff legs on each consist of two pieces of 3¼-in. O.D. tubing with a slip-over piece of 4-in. O.D. tubing with holes at intervals for adjusting height of the boom. Sheave plates and the flattened ends that fasten to the truck are the same fittings that were used on the former conventional derricks of steel tubing.



LIGHT WEIGHT of aluminum alloy derrick members enables workmen easily to hold leg in one hand and payload of truck is increased

Time and effort saved in assembling and disassembling derricks and the increase in pay load of the truck are big advantages of these lightweight derricks.

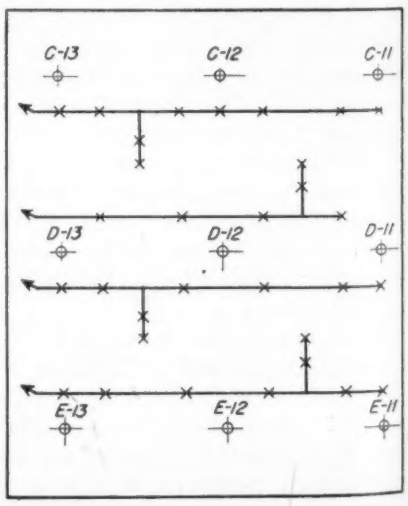
• • •

Flexibility in Lighting by Wiring Arrangements

A LAYOUT of a wiring system which will allow for frequent changes in the placement of lighting equipment has been developed through a study carried on by a large department store group and a manufacturer of various kinds of lamps.

The finding is reported in a paper entitled "A Field Study of the Practical Factors Affecting Illumination Design for Merchandising Areas" by William F. Rooney of Sylvania Electric Products Inc., Salem, Mass., presented recently before the Illuminating Engineering Society at Quebec, P.Q., Canada.

The wiring layout averages nine electrical outlets in a store bay approximately 20 ft. square, as shown in the illustration. This type of wiring grid would make many fixture arrangements possible without rewiring. It was found that various fixture patterns, such as one row per bay, two rows per bay, four individual units per bay, hollow square or hollow hexagon patterns in bays or around columns—all could be connected to at least one of the standard outlets. The four bays used in the



WIRING LAYOUT with nine outlets in a 20-ft. square bay provides flexibility for lighting fixture arrangement

field tests in the study were wired in this manner as a trial.

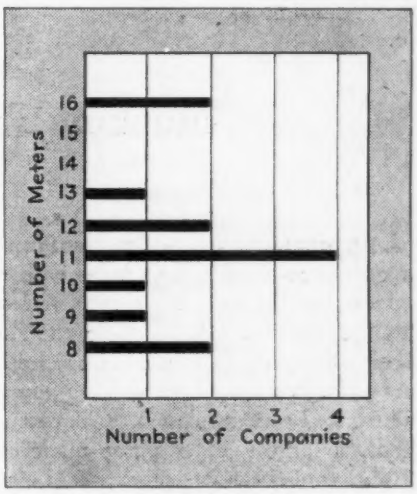
The author further reports: Economic feasibility of such wiring grids for new store construction is being studied by consulting engineers, and merchandisers generally were much interested in the possible flexibility of such wiring arrangements.

• • •

An ELECTRICAL WORLD *Comparison of Practice . . .*

How Meters Are Scheduled for Test

STATE UTILITY commission regulations control the frequency of residence meter accuracy tests in many cases, but difference of opinion is wide on most questions of meter testing. The practical necessity of frequent tests, in view of the extremely small over-all errors found, is a fundamental question. What constitutes a test, the best procedure, the facilities and routine, and how many tests can be made each day are other questions. Accessibility to meters on the customer's premises probably influences the number of tests and the cost of each test to a greater extent than the details of test procedure. Outdoor socket-type meters present an entirely different picture compared to base-connected meters in basements. Rows of meters in apartment houses give still another variable. Direct comparisons of results are therefore not feasible except with all the conditions stated.



AVERAGE number of meters tested per day per man (13 companies)

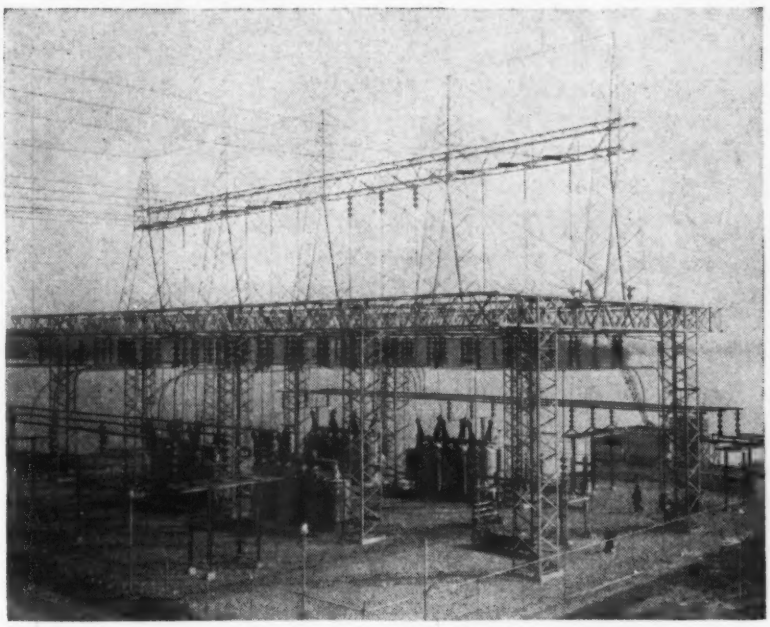
Test Schedules

War manpower shortages have greatly altered normal schedules for testing and many companies are reviewing their policies as they go back to a normal program. Of 16 companies included in this comparison, five followed an eight-year schedule, five averaged six years, five were on a five-year basis and one had not set a definite schedule. One company on a previous five-year basis expects to change to eight years.

The average number of meters tested per man per day varies from 8 to 16, with an average for the group of 11.5 meters per day. One company, reporting 40 inspections per day, did not remove the covers for routine check. Eleven companies open all meters for inspection regardless of the preliminary test, others only if this test shows accuracy outside the required limits, or if other conditions indicate.

Spread between accuracy limits is held to 1 percent or less by all except three companies, one permitting 1

Simplified Switching Layout



THE WAR-TIME switching installation shows the advantages of a fully symmetrical design even on a rather limited site. Material was employed economically by providing a structural steel bridge in four sections supported by five towers surmounted by ground wire ties at the top of the high-tension bus arbor and terminating the incoming circuits on strain insulators from which short vertical runs lead downward to the horizontal bus structures, from which taps are made to the circuit breakers. These are Allis-Chalmers' B-20, 60's, floor-mounted type, with maximum ratings of 161 kv. and 3,500,000-kva. interrupting capacity, ruptor equipped, and designed for 5-cycle opening and 20-cycle reclosing service. Post-type insulators saved conductor space and material. Ample clearances were provided

percent plus or minus and two permitting 1½ percent over-all.

It is quite apparent, and also logical, that newer types of meters which are compensated for overload and have the ability to take the high motor starting currents should not require the maintenance of older types subjected to the same conditions. This has led to the practice of varying procedures depending on types of meters. Advocates of scheduled maintenance are referring most frequently to the millions of older types of meters that are still in service. The accompanying tabulation summarizes details of maintenance for eleven companies.

Detail of Maintenance
(11 Companies)

	YES	NO
Are jewels oiled if cover is removed?	4	2
For pivot type only?	5	
Is register drag checked if cover is removed?	8	3
Is rotating element checked for variable friction?	7	4

Several companies report interest or definite plans for new procedures in areas where outdoor boxes or sockets are in extensive use. One company has started on a program of meter changes, replacing all meters and handling all tests and maintenance in the meter shop. Only variation would be on complaint tests where testing would still be on premises.

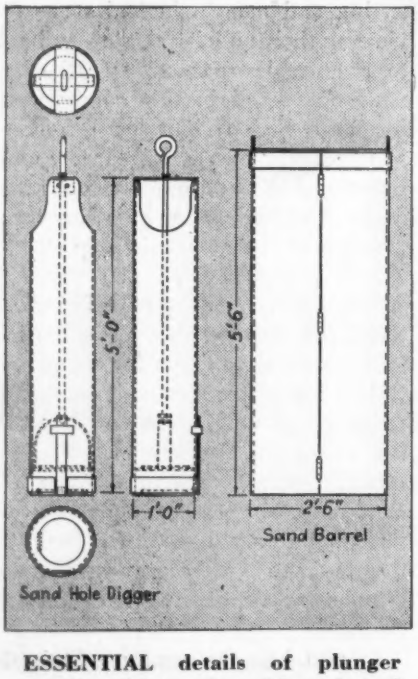
• • •

Mucking Pump Digs Pole Holes in 10 Minutes

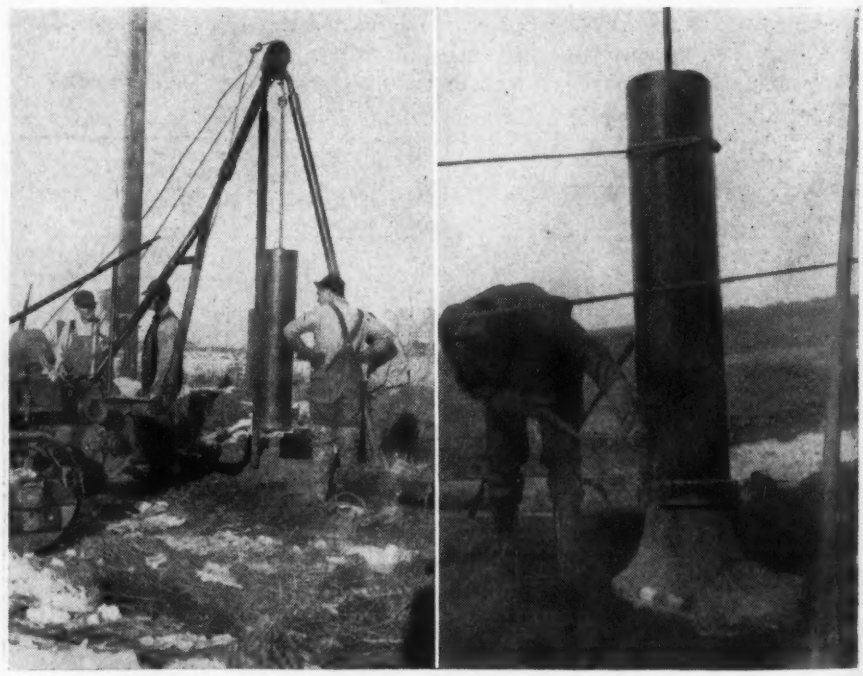
E. V. STUART, Public Service Co. of Colorado, Denver

THE DIFFICULTIES and length of time required to dig wet pole holes with a spoon, or by any other means, led Public Service Co. of Colorado to seek an easier and quicker method. As a result, the sand or mucking pump illustrated was developed. It is essentially a large plunger pump made of 10-in. round steel casing, 5 ft. long, with plunger, valves and piston as shown in the accompanying drawing.

Method of using is as follows: First, a hinged sand barrel or can, 24 in. in diameter and 5½ ft. long, is placed in the hole that has been dug with shovel and spoon as far as solid ground has permitted. The pump is then placed inside the sand can and with winch line to operate the plunger, several strokes of the pump are made to fill it with water, sand and/or muck. It is then raised and dumped and the operation repeated several times until the hole is deep enough. With sand can in place to hold up the sides of the hole, the pole is set, plumbed, and pikes grounded. By means of ears on the sand can and the winch line the can is withdrawn, unhinged and removed. Backfilling completes the setting of the pole.



ESSENTIAL details of plunger pump and hinged sand barrel used for digging wet pole holes



HOURS and even days are saved in digging water holes with this winch-operated mucking pump. Boom braces shown were found unnecessary after pump was tried out. Right view shows pump being emptied

The accompanying diagram shows the top of the tube of the pump cut away on two sides, whereas the pictures show the tube solid. Cutting the tube away as shown in the diagram was done after it was found that sand or gravel worked up above the plunger at times when the plunger becomes worn. Cutting the tube away gives more room to remove the sand or gravel by hand when this occurs.

With this glorified plunger pump, water holes can be dug in a matter of 10 min. or less, whereas with sand can and spoon it takes from a few hours to a couple of days to get a hole down. The pump is simple, inexpensive and can be easily made in most any utility's shops.

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EXCELLENT SERVICE OPERATING RECORD ALREADY PROVED

by extensive installations of Hi-Stroke arresters, mounted on Type HBA rural transformers, and mounted separately, on typical rural systems since 1944.

A new G-E development with many exclusive features:

Low Impulse Sparkover—Unexcelled in Expulsion-Type Arrester Field — Has an impulse sparkover level which corresponds closely to that of efficient valve-type arresters; hence provides a large margin of protection to either *new* or *old* transformers, and prevents flashovers and minimizes fuse blowing. The electrodes of the internal gap are fixed, maintaining a permanent gap length, and therefore a consistently low impulse sparkover voltage for individual discharges or for rapidly recurring multiple-stroke discharges.

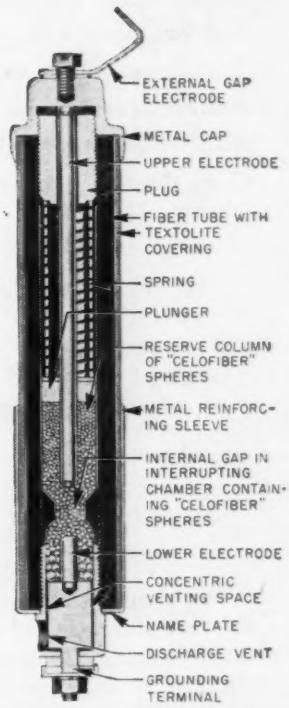
Counteracts Erosion — For Increased Arrester Life—The Hi-Stroke arrester is the *only* expulsion arrester which possesses a reserve supply of gas-evolving material in the arc path. In this unique construction a reservoir of celofiber spheres, under spring pressure, maintains a full complement of spheres between the internal gap electrodes in the arc-interrupting chamber and automatically compensates for erosion during discharge.

Negligible Arc Flame During Expulsion Action—Because of the very intimate contact of the arc with the gas-evolving material (celofiber spheres), the arc-extinguishing action is most effective and the arc flame attending expulsion action is practically negligible.

No Leakage Current Through Arrester Element—The line terminal and line side of the external series gap are supported by a liberally designed post insulator clamped adjacent to, *not on*, the arrester tube element. Hence any leakage current permitted by the insulator cannot pass through the arrester element, assuring that no voltage is applied to the arrester element except during actual discharge.

Cannot Cause Line Lockouts—External series air gap, plainly visible, indicates line not grounded. Even in event of failure of arrester element, line lead remains supported to post insulator and cannot dangle or come in contact with conductors, crossarm, pole, or grounded objects.

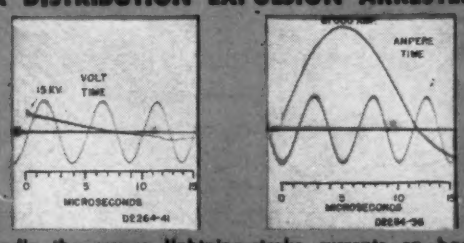
Exceptionally Small Size—Easy to Install with Various Mountings—The arrester construction is strong, compact, and durable throughout and permits choice of hangers for crossarm mounting or pole-mounting,—either separately or in combination with enclosed- or open-type distribution fuse cutouts.



Sectional view of Hi-Stroke rural arrester element.

HI-STROKE ARRESTERS MEET ALL AIEE AND NEMA STANDARD TEST REQUIREMENTS FOR DISTRIBUTION EXPULSION ARRESTERS

The Hi-Stroke rural arrester, with its 1200-ampere (rms), 60-cycle, current-interrupting rating, is capable of repeated operations interrupting even the full offset (asymmetrical) 2800-ampere, crest, short-circuit current.



Hi-Stroke arresters can handle the severe lightning-stroke currents on badly exposed rural lines, and readily withstand the AIEE and NEMA standard design test of 65,000 amp. (5 x 10ms) discharge current. (See above oscillograms.)

GENERAL ELECTRIC

405-20-5000

G-E also offers the PELLET ARRESTER — a valve-type distribution arrester applicable to urban or rural systems—having outstanding impulse protective characteristics and the new N_2-filled gap chamber. Because its operation and life are completely independent of system short-circuit currents, and because it has no exposed live parts, the PELLET ARRESTER is ideally suited for applications on urban systems.

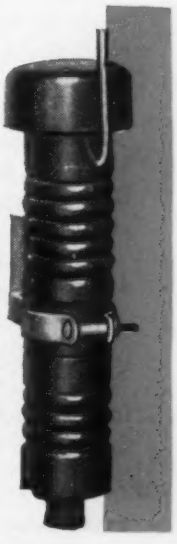
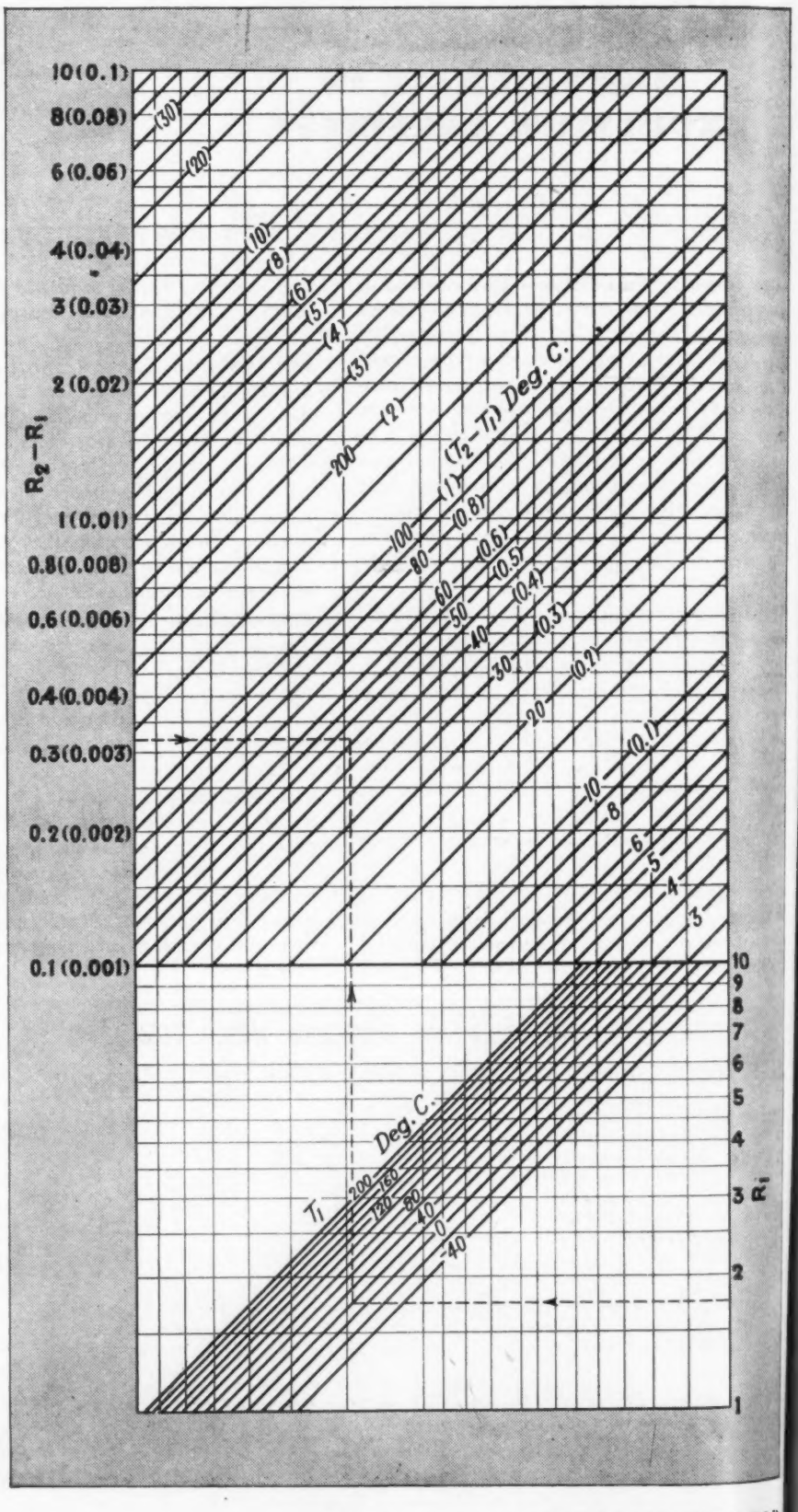


Chart to Determine Temperature Rise By Change of Resistance

LEO GORIN
Consultant
Hillburn Electronic Products Co.
New York, N. Y.

CHART is adapted for use in those cases in which one cold resistance measurement is made, followed by one or more hot measurements. Resistance values to three significant figures can be employed to read temperature values to 1 deg. C. in the usual practical problem.



Example For Chart

Problem: Heat run data on a d.c. armature. Cold resistance = 0.175 ohm at 20 deg. C.; hot resistance = 0.207 ohm. Determine final-temperature.

Solution: Use a factor of 10 to adapt the measured resistances to the chart scales; then $R_1 = 1.75$, $T_1 = 20$ deg. C., $R_2 = 2.07$ and $R_2 - R_1 = 0.32$.

Enter chart on right with R_1 and T_1, and from left with $(R_2 - R_1)$; dashed lines show temperature rise $(T_2 - T_1) = 47$ deg. C.

Final temperature $T_2 = 20 + 47 = 67$ deg. C.

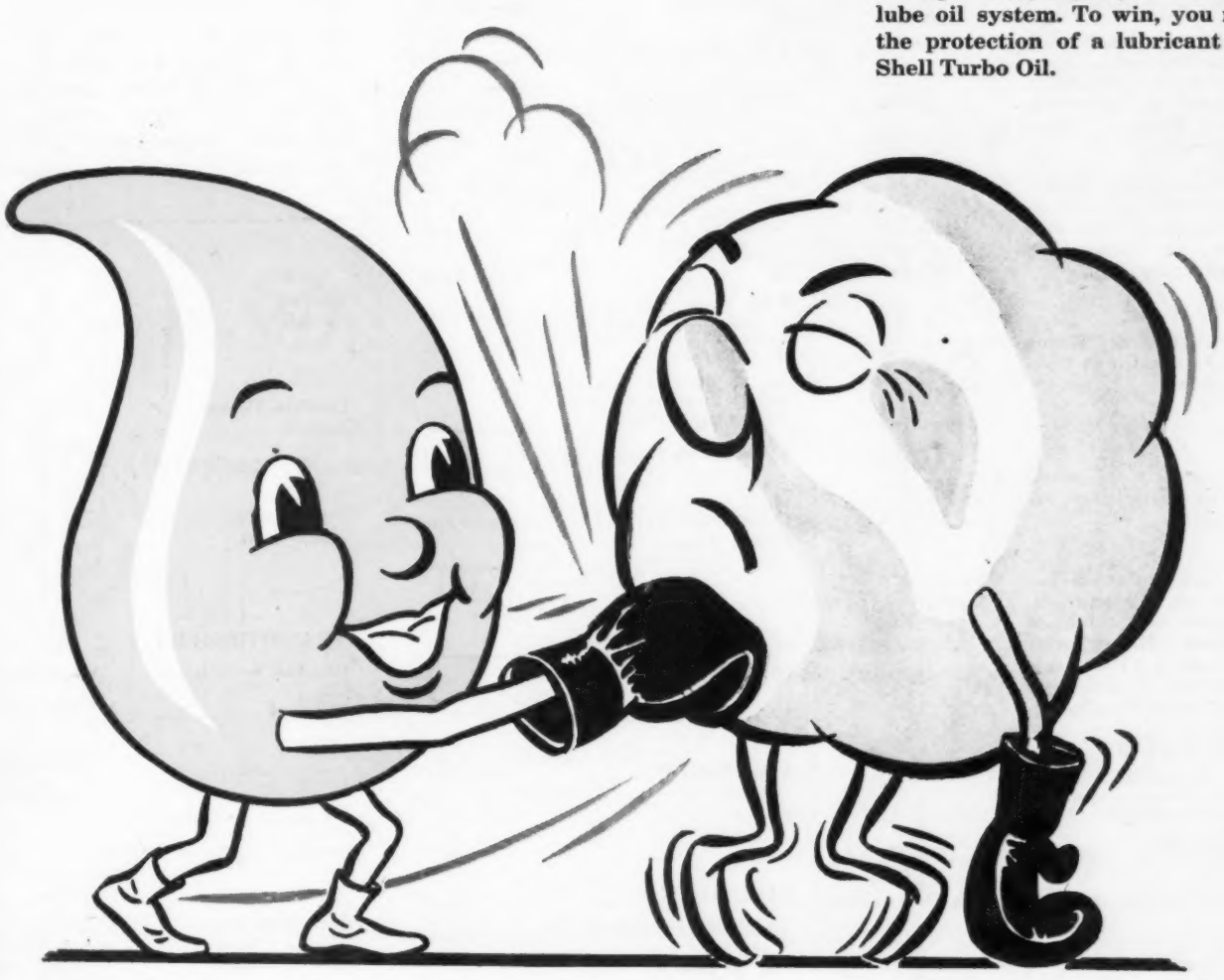
Chart is based on the formula:

$$\frac{R_2}{R_1} = \frac{234.5 + T_2}{234.5 + T_1}$$

for copper, and is suitable for aluminum of 60 percent conductivity.

The furious fight against OXYGEN

is fought every day in your turbine's lube oil system. To win, you need the protection of a lubricant like Shell Turbo Oil.



SHELL TURBO OIL protects your turbines...

Shell Turbo Oil is refined by a special process that removes those oil components which most readily oxidize.

In addition, Shell Turbo Oil incorporates an anti-oxidant and a rust-preventive that still further retards the formation of lacquer, gum and sludge . . . gives extra protection to your turbine's lube oil and control system.

The Shell Lubrication Engineer will gladly tell you the full story of Shell Turbo Oil. Get his advice on the lubrication of any type of steam turbine. For literature, write Shell Oil Company, Incorporated, 50 West 50th Street New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL

SHELL TURBO OILS

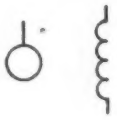
Standardized Symbols For Electric Power and Control . . . II

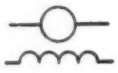
MACHINES, ROTATING

(One Line Symbols)

Squirrel Cage, Repulsion and Split Phase Induction Motor or Generator or Rotary Phase Converter . . . . .

Wound Rotor Induction Motor, Synchronous Induction Motor or Induction Generator . . . . .

Synchronous Motor or Generator or Condenser . . . . . 

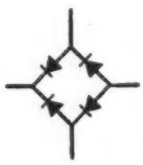
Separately Excited D.C. Generator or Motor . . . . . 

D.C. Compound Motor or 2-Wire Generator or Stabilized Shunt Motor with Commutating and/or Compensating Field Winding .

RECTIFIERS

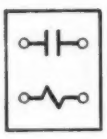
Dry or Electrolytic
(For schematic or elementary diagram)

Half Wave . . . . .

Full Wave . . . . . 

RELAYS

Fundamental symbols for contacts, coils, mechanical connections, etc., are the basis of relay symbols

Overcurrent or Overvoltage Relay with 1—NO Contact 

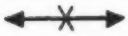
General Function Symbols

Over . . . . .

Under . . . . .

Direction . . . . .

Balance . . . . .

Differential . . . . . 

Pilot Wire . . . . .

Carrier Current . . . .

RESISTORS

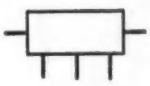
General . . . . .

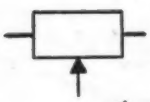
or . . . . .

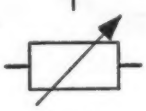
* This symbol must always be used with an identifying legend within or adjacent to the rectangle.

(In any adaptation either of the above two fundamental symbols may be used).

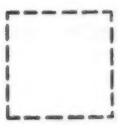
Fixed, with leads . . .

Adjustable by Fixed Taps . . . . . 

Adjustable Top or Slide Wire . . . . . 

Continuously Adjustable . . . . . 

SHIELDING

Indicated by dotted lines surrounding the device . . . . . 

SWITCHES

(One Line Symbols)

Fundamental symbols for contacts, coils, mechanical connections, etc., are the basis of switch symbols. In addition, the following are fundamental for switch symbols.

Disconnecting Device (Coupling or Plug Type Contact) . . . . .

Disconnecting Switch . . . . .

CONTINUATION of graphical symbols, standardized to depict frequent items of electric equipment on drawings, as listed in ELECTRICAL WORLD, January 18, 1947, page 172, and to be concluded in an ensuing issue. Items are a selection from the approved American Standards Association list.

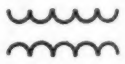
Knife Switch . . . . .

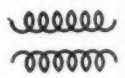
Double-Throw Switch . . . . .

Switch with Horn Gap . . . . .

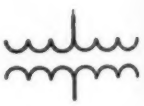
TRANSFORMERS

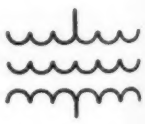
(One Line Symbols)

General . . . . . 

or . . . . . 

(In any of the adaptations either of the two fundamental symbols may be used)

Two Winding Single Phase or Polyphase . . . . . 

Three Winding Single Phase . . . . . 

With Taps . . . . .

Constant Current . . .

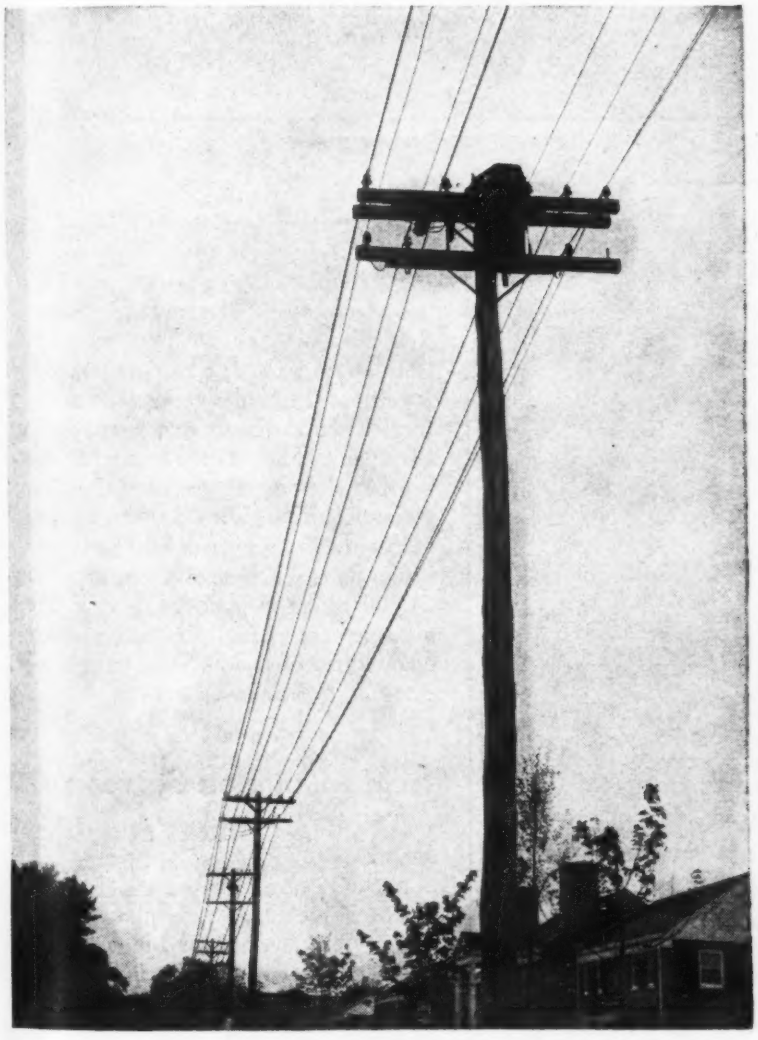
Auto-transformer . . .

Potential . . . . .

Current . . . . .

No more Scarecrows *in the sky*

URC WEATHERPROOFING HAS ENDED FESTOONING



Going . . . going . . . the familiar but unwelcome sight of festooning wire is destined to disappear. URC Weatherproof has licked the problem. Intensive research . . . the development of superior saturants and finishers . . . exhaustive weather tests have resulted in Weatherproof that lasts longer—won't come apart and festoon. Specify *Anaconda* URC Weatherproof. 47487

For continuity of service —Anaconda DURALINE or TRIPLE BRAID URC.

The resistance to flow and the stability of URC saturants and finishers, together with improved manufacturing techniques, mean longer life to weatherproof. URC Weatherproof has ended festooning.

LOOK TO *Anaconda* FOR WEATHERPROOF THAT LASTS! ANACONDA

Production Costs for Plant with Topping Unit

OPERATING DATA filed with a state utility commission for a steam plant with an over-all rating of 116,500 kva. in 1945 indicate that a total output for the year of 573,841,120 kw.-hr. was obtained at a running cost of 3.97 mills per kw.-hr.; assumed overhead charges of 15 percent on the reported investment of $10,283,800 add 2.69 mills, making the total cost 6.66 mills for each kw.-hr. generated by this station.

The plant contains six boilers and three turbo-generating units, the latest of these being a 28,000-kva. machine superposed on one 40,000-kva. unit and one 43,500-kva. unit. Five of the boilers were installed about 20 years ago (as were the two larger turbines) and the two older turbines operate at 375 psi. and 725 F., being condensing units. The newest boiler, rated at 650,000 lb. per hr., supplies steam at 1,825 psi. and 960 F. to the topping turbine, which exhausts into the 375-psi. mains, and was installed approximately four years ago.

Summary of Over-All Generating Costs, 1945

(Cents Omitted)

		MILLS PER KW.-HR. GENERATED
Superintendence	$21,190	
Boiler labor	96,812	
Turbo-generator and switchboard labor	70,578	
Miscellaneous labor	23,943	
Fuel	1,836,748	3.25 mills
Water for steam	8,573	
Lubricants	2,442	
Station supplies	30,116	
Maintenance, station structures	17,472	
" boiler plant equipment	104,540	
" turbo-generator units	58,649	
" accessory electrical equipment	5,238	
" miscellaneous equipment	1,766	
Total excluding overhead charges	$2,278,087	3.97 mills
Estimated overhead charges	1,540,000	
Total investment in plant	10,283,800	
Annual charges, 15 percent of above	1,540,000	2.69 mills
Total cost of operation and overhead	$3,818,087	6.66 mills
Total generation in 1945	573,841,120 kw.-hr.	

Fuel burned.

Bituminous coal, short tons, 248,538. Average cost per ton used and unaccounted for, approximately $6.57.

Fuel oil, barrels of about 42 gal each, 101,947. Average cost per barrel used and unaccounted for, approximately $1.82.

Maximum load on plant	94,700 kw.
Average generating load on plant	65,400 kw.
Load-factor for year, station	69 percent
Total plant rating in generating units, including 5,000 kva. in auxiliary generators	116,500 kva.,

The topping unit was installed, the reports of the company to the commission for 1941 provided data from which it can be estimated that the Btu. per kw.-hr. generated were about 14,420; whereas the plant is estimated to have generated energy in 1945 on the basis of about 13,550 Btu. per kw.-hr. These computations are based upon an assumed heating value of fuel oil of 151,000 Btu. per gal., barrel capacities of 42 gal., and bituminous coal heating values of 14,300 Btu. per pound. In 1945 the average cost of fuel (including unaccounted-for fuel) was $1.82 per barrel of oil and $6.57 per short ton of coal.

Street Lighting Cable Plowed in Trench

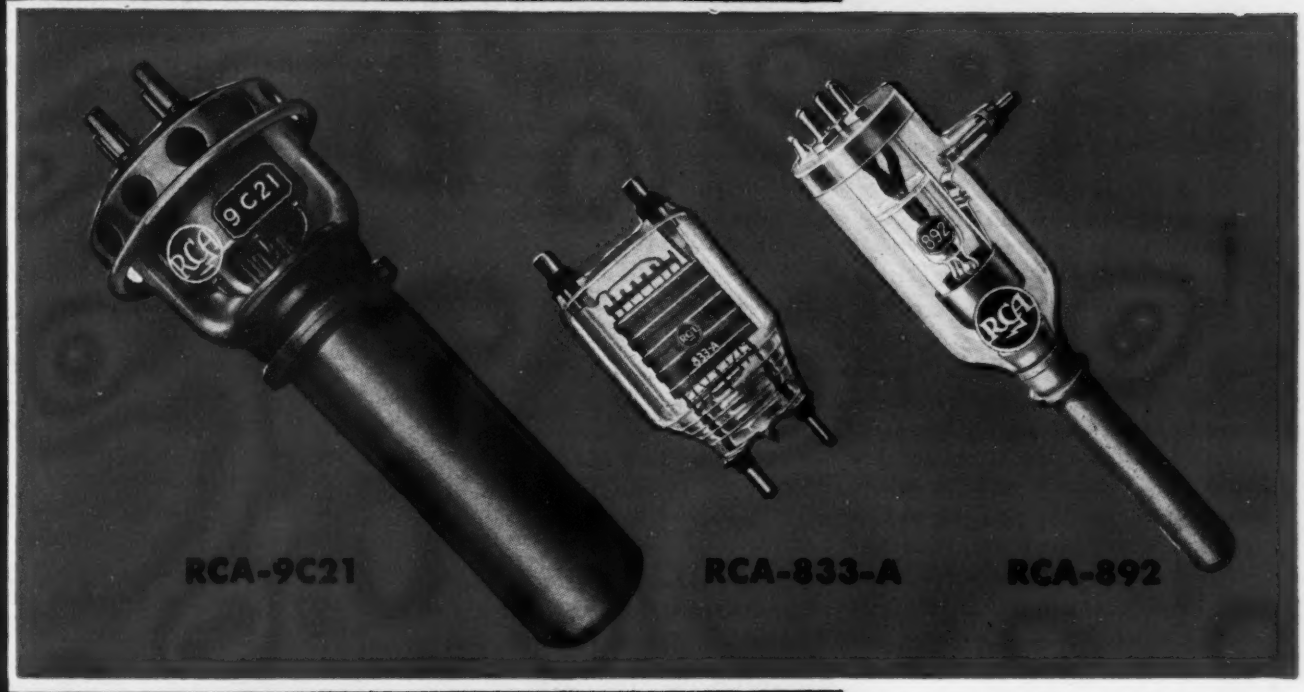
TO ELIMINATE digging trenches for installing boulevard street lighting cable, an underground crew of Indianapolis Power and Light Co. recently used a tractor plow for an extensive addition in suburban Indianapolis. As shown in the accompanying illustration, the cable was carried on a truck traveling parallel to the plow. The narrow-gage plow digs a furrow 18 in. deep into which the cable is guided by a funnel

Heat Insulation Solves Breeching Troubles

THE Sayreville, N. J., plant of the Jersey Central Power & Light Co. exhibits a novel use of thermal insulation with remarkable benefits, on the breeching from the discharge point of an induced draft fan to the stack.

Following multiple advantages ensue from the breeching insulation:

For economy in Electronic Heating...



Replace with RCA Power Amplifiers

RCA industrial electron tubes for high-frequency heating equipment embody the ruggedness, high quality and long-service life required for continuous-duty applications. You can count on them for top performance and economy.

The RCA Power Amplifiers illustrated are representative of a large and growing family of RCA electron tubes for industrial use.

At present, there are over 200 *standard* types. Included in this group is a comprehensive line of ignitrons and thyratrons for control applications, and an equally comprehensive line of high-vacuum and mercury-vapor rectifiers for low- and high-voltage applications.

When you need renewal tubes, look to RCA.

SEND FOR BULLETIN

Radio Corporation of America
Commercial Engineering
Section T-45B, Harrison, N. J.

Please send me Bulletin No. 2F237 covering prices, technical description and interchangeability by type numbers of the complete line of RCA industrial electron tubes.

Name_____

Street Address_____

City_____

Zone_____ State_____

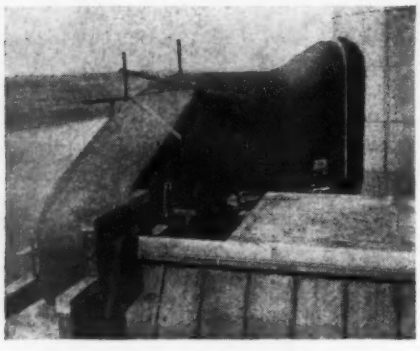
RCA LABORATORIES,
PRINCETON, N. J.

IN RADIO AND ELECTRONICS—*THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA*

TUBE DEPARTMENT

RADIO CORPORATION of AMERICA

HARRISON, N. J.



BREECHING from plant to stack is insulated with 4-in. mineral wool blanket to sustain temperature of exhausting gases above dew point of sulphurous vapor present

The breeching no longer requires painting to protect it from corrosion caused by exposure. The gases exhausted through the stack are kept safely above the dew-point of sulphur gases present in the products of combustion. They pass off, therefore, without condensing and corroding the stack inside. The higher gas temperature, further, tends to sustain draft and slightly reduce the power required by the fans. Moreover, it prevents condensation in the air pre-heaters of acids, which formerly combined with the dust to make a firm binder. This previously occurred at times when the load was light and the temperature fell. Cleaning of the pre-heaters was inconvenient, laborious, and costly. Neglect of cleanings was worse, for it reduced draft and, therefore, capacity. Finally, the magnetic coupling of the induced draft fans is now protected for disturbances caused by excessive heat, heat developed from contact with hot ambient air in addition to the normal electrically induced heat of magnetic slippage.

Accompanying illustration shows the location of the breeching high on the roof of the plant. Insulation consists of 4-in. mineral wool blanket covered with a ¼-in. coat of asphaltic waterproofing. A finish coat is yet to be applied but this will affect only the appearance. The Sayreville plant is located on a coastal plain near the shore, and subject alternately to the full sweep of prevailing west winds and frequent salty winds from the sea. Moreover, salt water is present in the tidal river to the west of the plant. Induced draft fans are located close to the origin of the breeching where it emerges from the roof to approach the stack. They exhaust gases into the breeching at 300 to 350 deg. F. Uninsulated breeching, especially in this exposed location, would invite a serious loss of heat during the passage of exhaust gases to the stack so that the gases would reach the stack at greatly reduced temperature.

The heavy mineral wool insulation now protecting the breeching sustains the temperature within the breeching until the hot gases reach the stack so that they do not drop below the dew-point of sulphurous gases until they reach the open air.

•

Tree Trimming on Rural Lines in Connecticut*

G. J. WILLIAMS
Division Manager
Connecticut Light and Power Co.
Willimantic, Conn.

A MAJOR FACTOR in the cost of rural lines on the Connecticut Light and Power Co. system is clearing and tree trimming. Early practice covered safe clearing of the lines when first built, but experience has indicated that this soon involved maintenance trimming. Hence more attention is now given to increased removal of trees and particularly high underbrush when the line is built. It appears that although the initial cost of increased tree trimming and removal is higher, the practice accomplishes (1) more easily obtained permission for adequate trimming and clearing when the line is built, and (2) reduction of maintenance costs and minimizing of line interruptions. The company is now experimenting with joint trimming and clearing, sharing the cost equally with the telephone companies. Considerable contract trimming is done.

•

Periodic Secondary Voltage Tests

ON AN EASTERN POWER SYSTEM periodic voltage tests are made once in four years on all secondary systems supplied from 5-kva. or larger transformers, excluding power customers' separate circuits and a.c. network secondaries. Such tests are also made on secondaries served by 5-kva. or smaller transformers if it appears that voltage may be low due to long runs.

Tests are made by qualified men from the meter department or by maintenance electricians, with instruments previously tested for accuracy. Test period normally is between October 15 and February 1. All tests are with graphic voltmeters, normally removed after one day. At least one test is made at the end of each secondary system.

If the transformer is intermediately located, two tests may be made simultaneously, one at each end. As far as possible tests are made on the premises of a 3-wire customer, using two voltmeters (one on each side of the system) at each location. Tests are not made on very dark days nor under unusual operating conditions. When installing or removing test meters, transformer Thermotel readings are made and recorded, using a telescope if needed, and recording "No Thermotel" where none exists. Test men are not required to reset Thermotels.

Locations Selected

System maps are used to indicate sections and years in which voltage tests are made. The maintenance supervisor plans these tests, entering on work orders the street and number of customers' premises selected for tests. Test men are given proper identification cards, assorted fuses, flashlights and telescope. A list of test locations selected for each day is left with the meter department when instruments are withdrawn for this purpose. Instructions are detailed as to approach of customers for permission to install test meters and return the next day, selection of favorable locations for graphic meter test usage, avoidance of locations likely to annoy customers, identification of testers, and selection of next best test places if necessary to withdraw.

Instruments are installed as near the service entrance as possible and on the supply side of branch circuit fuses. If shunted fuses are found, the test man is expected to advise the customer of the menace involved and correction requested. If current diversion is found, everything is left intact and the condition confidentially

* From a paper before the seventh New England Rural Electrification Institute, Amherst, Mass., April 17, 1946.

VALUE
Conductors are perfectly centered and will always remain so.
VALUE
Inner felted asbestos wall takes the heat of overloaded conductors.
VALUE
Asbestos - protected varnished cambric for high dielectric strength.
VALUE
Outer asbestos wall withstands high ambient temperatures.
VALUE
Asbestos braid resists heat, moisture oil, grease, fumes and flame.

ROCKBESTOS A.V.C.

is the BEST BUY when HEAT and FUMES are factors

When circuits must be exposed to baking heat and corrosive fumes—close to boilers, steam lines and hot ash pits, for instance—you can make no better buy than Rockbestos A.V.C. For this *permanently insulated* cable not only withstands high temperatures (up to 230°F.) without baking out or cracking, but will endure indefinitely under heating and cooling cycles in conduit or duct installations. Its *impregnated asbestos* insulation also resists flame, moisture, oil, grease and oxidation.

The wide range of constructions in voltage ratings of 600 to 5000 includes asbestos braid covered, lead sheathed and armored single and multi-conductor power cables, similarly made control cables, switchboard and lighting wires, and other Rockbestos-designed National Electrical Code types.

For a catalog or samples write to the nearest district office or:

ROCKBESTOS PRODUCTS CORPORATION
179 Nicoll St., New Haven 4, Conn.

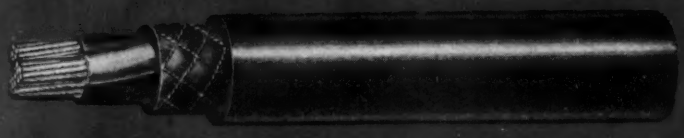
Advantages You Get in Rockbestos A.V.C. 600 Volt Power Cable—Code Type AVA

The cable illustrated and similarly insulated Motor Lead Cable (Nat. Elec. Code Type AVA) have a maximum operating temperature of 110°C., and this failure-preventing construction:

- The conductor is perfectly and permanently centered in helically applied non-flowing heat, flame and moisture resistant insulation that permits greater current carrying capacity.
- An inner wall of impregnated felted asbestos that withstands conductor-heating overloads and won't bake brittle or burn.
- Asbestos-protected varnished cambric for high dielectric strength and added moisture resistance.
- An outer wall of heat, flame and moisture resistant impregnated felted asbestos that won't dry out, crack, flow, rot or burn.
- A tough age-resistant impregnated asbestos yarn braid that resists moisture, oil, grease and corrosive fumes as well as heat and flame.

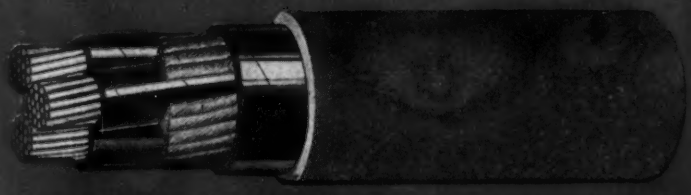
One of 125 different constructions designed by Rockbestos for severe or unusual operating conditions.

CRESCENT
WIRES & CABLES
Will Meet Your Need



Imperial Neoprene Portable Cords & Cables

Rubber Covered Wires & Cables



Varnished Cambric Lead Encased Cable

Parkway Cable, All Types

AND AMONG OTHER TYPES THE FOLLOWING

ABC Armored Cable
Armored Ground Wire
Bare Copper Wire & Cable
Bell Wire
Brewery Cord
Control Cables
Fire Alarm Cables
Fixture Wires
Flexible Cords
Flexible Steel Conduit
Heater Cord
IMPERIAL CRESCORD Jacketed Cord
PERMACORD
Power Cables
Service Entrance Cable
Shipboard Cable
Signal Cable
Slow-Burning Wire & Cable
Switchboard Wire & Cable
Telephone Wire & Cable
Thermostat Cable
Trench Cable
Weatherproof Wire & Cable
Welding Cable

CRESFLEX Non-metallic Sheathed Cable

CRESCENT
WIRE AND CABLE
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

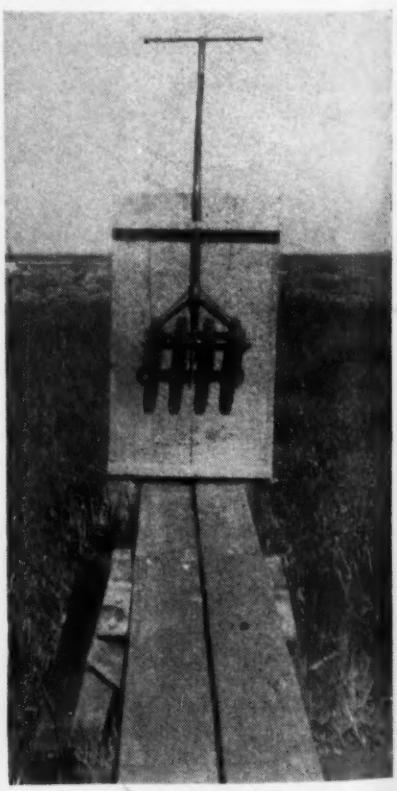
reported to the meter foreman for action.

Test men are required to refrain from unnecessary conversation with customers concerning company business or city inspection department matters; from recommending any one contractor alone, using tobacco on the premises or taking friends upon these. Great care is used to avoid defacing or damaging property and to restore objects to previous locations when borrowed. Test men are not allowed to repair wiring or appliances, but advise that such work be done by an electrical contractor. Test records are studied by the maintenance supervisor, who may order additional tests, and who informs the company's maintenance engineer if he deems corrective measures necessary. Transformer load cards carry voltage test results as a permanent record.

•

Four-Wheel Dolly Doesn't Dump Its Load

THE IDEA of using a four-wheel dolly as illustrated has made it easier and safer for maintenance crews of Pacific Gas and Electric Co. to trans-



FOUR-WHEEL DOLLY beats wheelbarrow on narrow board walks for transporting maintenance material along transmission line

FROM NO. 10 TO 1,000,000 CM

KEARNEY Con-Nec-Tites

Assure Safer, Better Construction – Faster

Maximum Uniform Pressure Means Positive Permanent Solderless Connections

Developed and introduced by Kearney engineers, the Con-Nec-Tite is the original solderless connector. Millions of these connectors have been used—and they are still the most popular solderless connector on the market.

Here's Why–

Clean uniform threads and thread lead pilots permit the nuts to go on easier. Precision rounded corners prevent nicking wire. Hex nuts and heads fit the wrench snugly. Correct slot width and V-grooves in washer and head hold conductors under uniform pressure without injury—assures good conductivity. Weather resistant material gives long service and permits using them over and over.

Con-Nec-Tites are available for all combinations of metallic conductors. They are your best bet for best construction.

70

For Better Results

Specify Kearney Products

JAMES R. KEARNEY CORPORATION

OVERHEAD AND UNDERGROUND UTILITY EQUIPMENT

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"GREENLEE BENDER
pays for itself on one job"

"On one recent conduit job alone, our GREENLEE Bender has paid for itself through labor and materials savings," reports Mr. E. O. Matz, head of Matz Electric & Radio Co., Harlingen, Tex.

"Moreover," he continues, "it has paid for itself many times during the period it has been in service . . . labor savings run as high as 50%, savings on fittings and manufactured bends, 50% to 75% . . . this company would not be without it!"

Let a GREENLEE make valuable time and materials savings on your jobs, too. With it, *one man* can quickly make smooth, accurate bends in rigid and *thin-wall* conduit, pipe up to 4½", tubing, bus-bars.

Whatever your bending job, there's a GREENLEE to do it faster, smoother, better. Write for complete facts. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1802 Columbia Avenue, Rockford, Illinois.

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

port timbers and miscellaneous materials along board walks used under transmission lines in swampy areas. Four solid rubber tired wheels with roller bearings are spaced equally on a solid axle. If one wheel runs off the board walk or gets into a crack, the load is not spilled with such a wheel arrangement. Two such dollies without the box are used, one at each end of long timbers, to transport them easily and around turns along the walkway. This idea suggested by G. A. Rose and D. A. Bochelder of P. G. & E. may have application on walks along flume lines, coal bins, or to other uses as well.

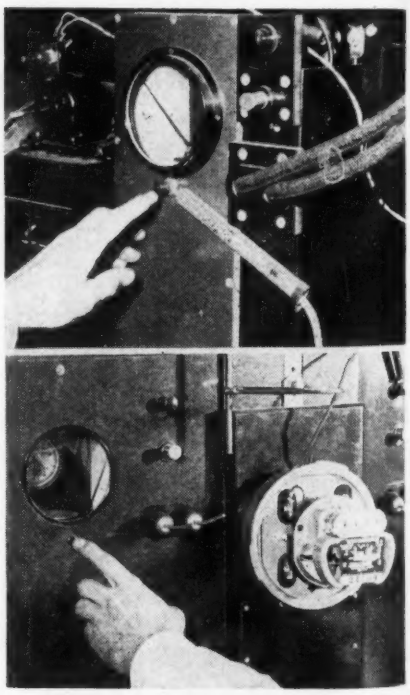
•

Master Reset Button Speeds Meter Testing

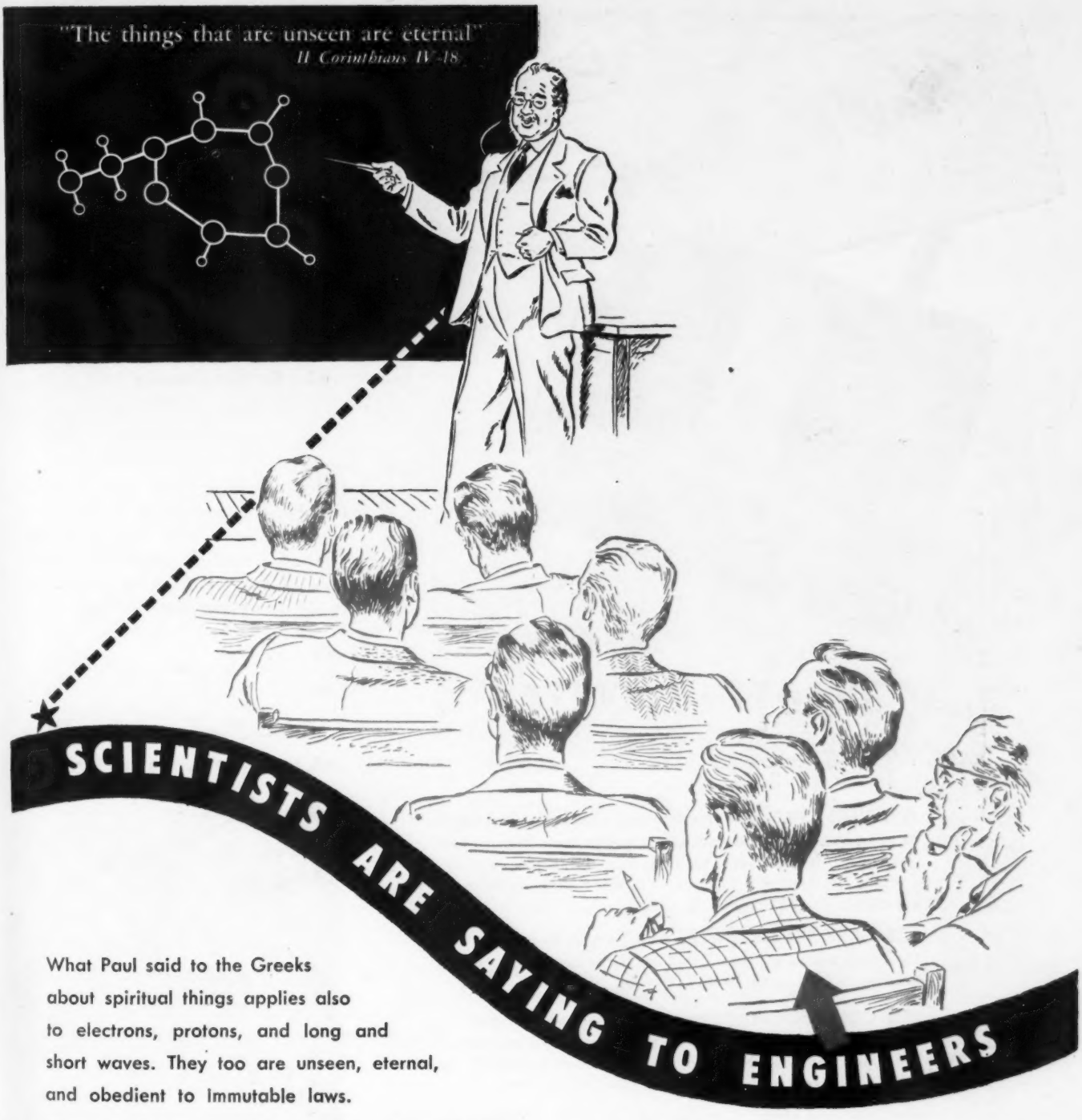
H. D. NOREN

Coast Counties Gas & Electric Co.
Santa Cruz, Calif.

PHOTOTUBE TESTING of meters was speeded and made more convenient by Coast Counties Gas & Electric Co. with the addition of the master reset button shown. By means of this



RELAY resetting switch is combined with rotating standard reset button in phototube testing of meters. Face of test board (top) showing button conveniently located. Front panel (below) removed to show relay reset switch. Small fiber sleeve on rotating standard reset button actuates simple spring contact



SCIENTISTS ARE SAYING TO ENGINEERS

What Paul said to the Greeks about spiritual things applies also to electrons, protons, and long and short waves. They too are unseen, eternal, and obedient to immutable laws.

They are forever going somewhere. They can heal or kill. They can give light and sound and heat and power if we control them.

Insulating materials are one of our most important tools for this job. For more than thirty years Formica has been one of the best tools for many such purposes, and definitely the very best for some.

You are the judge, but good as its reputation is, you will not try to judge Formica for your purpose without examining the properties and specifications of the various grades, and considering their strength, durability, workability and cost. Why not ask us to send this information on a grade we can recommend for the purpose you mention in your letter. It might call for one of the grades that are too new for you to know what it could mean for you.

FORMICA

THE FORMICA INSULATION COMPANY 4630 SPRING GROVE AVENUE, CINCINNATI 32, OHIO

IT'S VERSATILE—Used for detecting and diagnosing trouble in nearly all types of electrical equipment including: motors, generators, transformers, switchboards, appliances, lighting circuits, meters and relays . . . practically *everything* electrical.

IT'S EASY TO OPERATE—Simply make connections, turn the crank and take a direct reading. It's as simple to read as a voltmeter. Ratings up to 50 megohms, 500 volts.

IT'S CONVENIENT—Requires no external power supply, no adjustments, no batteries or replacement parts. DC test current is supplied by a self-contained hand-operated generator—an unfailing source, *always* ready for use.

IT'S INSURANCE—Insulation testing with a "Megger" Tester is your first line of defense in electrical preventative maintenance . . . your protection against moisture and other enemies of electrical insulation . . . a *must* in your struggle for uninterrupted electrical service.

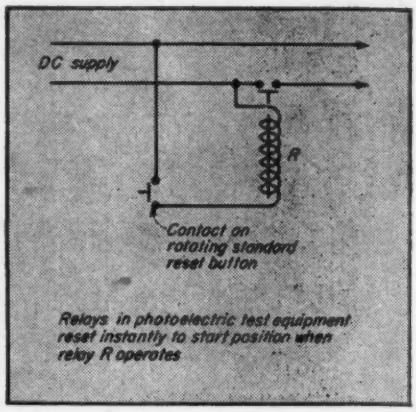
* Trademark Reg. U. S. Pat. Off.

READ THIS BULLETIN . . . Here's the ABC of the Midget "Megger" Insulation Tester, telling briefly and in common sense language just what the Midget "Megger" Tester is, how it is used . . . AND . . . what it will do for you. Write for your copy of Bulletin 1785-W *today.*

James G. BIDDLE CO.

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.


DC supply
R
Contact on rotating standard reset button
Relays in photoelectric test equipment reset instantly to start position when relay R operates

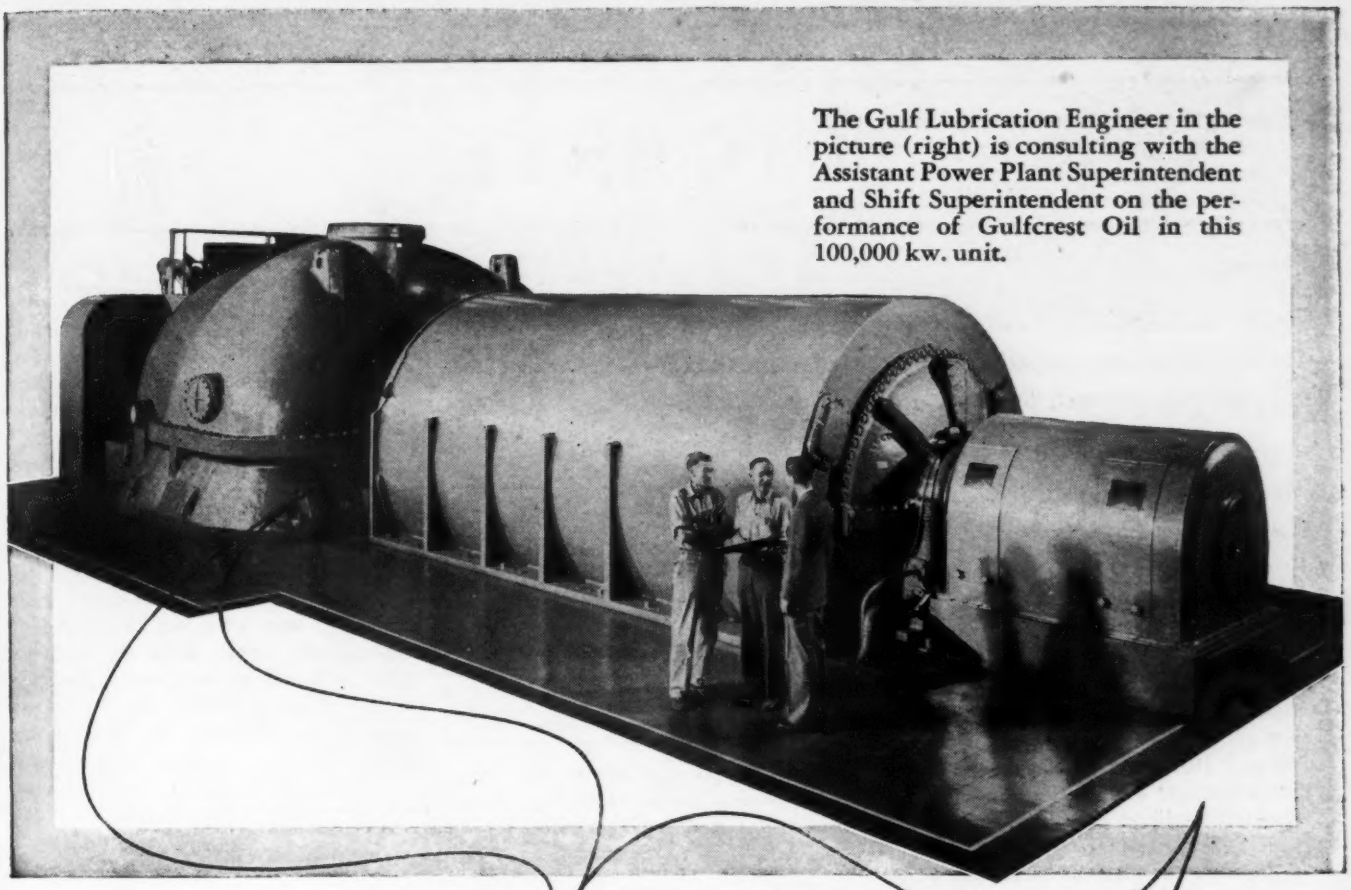
HOW switch is wired to master relay for meter testing

switch, which was added to a meter test panel made by Electrical Facilities of Oakland, Calif., the relays of the phototube test equipment are reset with the same one operation that resets the rotating standard. Essentials of the reset circuit are shown in the accompanying diagram.

•

Ladder Platform for Prolonged Work from Ladder

ADJUSTMENT to fit the angle of the ladder is provided in this ladder platform designed by Frank Wilcox, repair shop superintendent at Green Bay Plant of Wisconsin Public Service Corp. A dowel and thumb screw fit in a series of ⅜-in. holes spaced ½-in. along the lower end of the ¼-in. x 1¼-in. leg irons. The standing platform is of hardwood 12 in. x 17 in. and a street lamp chain around the platform edges prevents slipping



The Gulf Lubrication Engineer in the picture (right) is consulting with the Assistant Power Plant Superintendent and Shift Superintendent on the performance of Gulfcrest Oil in this 100,000 kw. unit.

GULFCREST OIL

provides safe, sure, efficient lubrication for another big turbine—100,000 kw.

ANOTHER MODERN POWER PLANT insures its big investment by lubricating with Gulfcrest, the world's finest turbine oil!

And, after 21,000 hours of service in this 100,000 kw. unit, Gulfcrest Oil is again demonstrating its unmatched performance and long life. Neutralization number: 0.015. Make-up: 20 gallons per month.

Extra refining makes the difference! After the carefully selected crude oil used in Gulfcrest goes through the major refinery methods, it is then superrefined by the Alchlor Process.

More than 15 per cent of the oil is discarded by the Alchlor Process—this 15 per cent contains the hydrocarbons most apt to oxidize and form sludge, emulsifiers, and harmful acids.

That's why Gulfcrest is incomparably pure—why it gives outstanding performance, and lasts indefinitely. Send the coupon below for a booklet which gives you the complete facts on this superior oil.

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DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

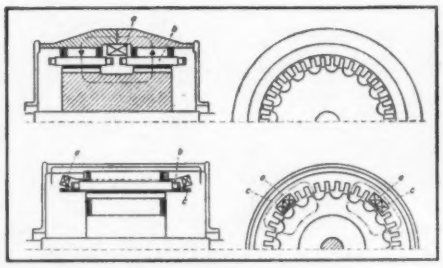
Medium Frequency Generators

From an article by A. Schnetzler in "Bulletin Oerlikon," Zurich, Switzerland, Vol. 24, No. 251.

HETEROPOLAR generators are made for three-phase loads at frequencies up to 1,000 cycles, while homopolar generators are made for the range between 500 and 10,000 cycles in a line of machines brought out by Ateliers de Construction Oerlikon.

Heteropolar generators are similar to the inductor alternators of about 50 years ago, in which a single ring winding placed at right angles to the rotor shaft and carrying direct current provides flux in a number of pole shoes partially surrounding the coil and rotating with it. These shoes are so shaped that sine waves are generated in the stator coils, which are similar to those for an ordinary stationary armature. The construction obviates the need for many delicate field coils and permits a rugged construction for the rotor, while the magnetizing current is low. On account of the shape of the pole shoes only one armature coil and one slot per hole per phase is needed. These machines are used principally for remote control of networks over the power lines and for supply of current for high-speed motors.

Homopolar machines, an adaptation from the homopolar generator of the last century, are somewhat similar, but the field and armature windings are both attached to the stator, and the only rotating element is an iron inductor with teeth which bunch the flux. Exciter coils are of two types, one an annular ring similar to that of the heteropolar generator, and the other a set of coils placed in slots and forming salient poles. With the annular winding two sets of armature coils are used, one set at each end of the armature, while with the salient pole winding the armature coils are placed in slots in the core of the stator as in an ordinary a.c. generator.



HOMOPOLAR generators are of two types: a, exciter coils; b, armature coils; c, damper winding

While the performance of the homopolar machine is inferior to standard generators or to the heteropolar generator, it can be built for much higher frequencies. The principal use is for industrial heating, such as melting of metals and surface hardening.

Mechanical Laying Of Underground Cables

From an article by P. F. Clark in "The Electrician," London, June 21, 1946.

CABLES may be laid underground by a plow train such as that described by the author (see ELECTRICAL WORLD, January 5, 1946, page 72) or by a second method using a mechanical excavator and reinstator. In the latter method the earth is excavated with a machine which cuts a trench 7 in. wide and as deep as 2 ft. 10 in., laying the excavated earth alongside. Next the cable is laid from a tractor carrying the reel and paying out the cable between adjustable guides which direct it into the trench.

After the cable is laid, about 3 in. of fine soil is pushed back into the trench and consolidated by rolling. Then a 4:1 concrete grout is poured in from a concrete mixer carried on a truck trailer, the usual depth placed being 2 in. After a half hour for setting the trench is backfilled, using a small angle bulldozer where possible, and then the loose ground is rammed with a mechanical rammer or by hand.

The cable plow is preferable for fairly long lines in open country, but the trenching method is used for short runs or where the route is alongside the highway. In a few places, as where a road must be crossed and the pavement cut, handwork is necessary.

Mechanical laying requires only about one-tenth as many men as hand laying to complete a job in equal time. Before the war, with hand installation, underground cable lines cost about twice as much as overhead lines, but with mechanical laying they now cost only 25 percent more. In view of the longer life and smaller maintenance for underground cables the final cost difference will be very small.

Telephone Interference From Power Systems

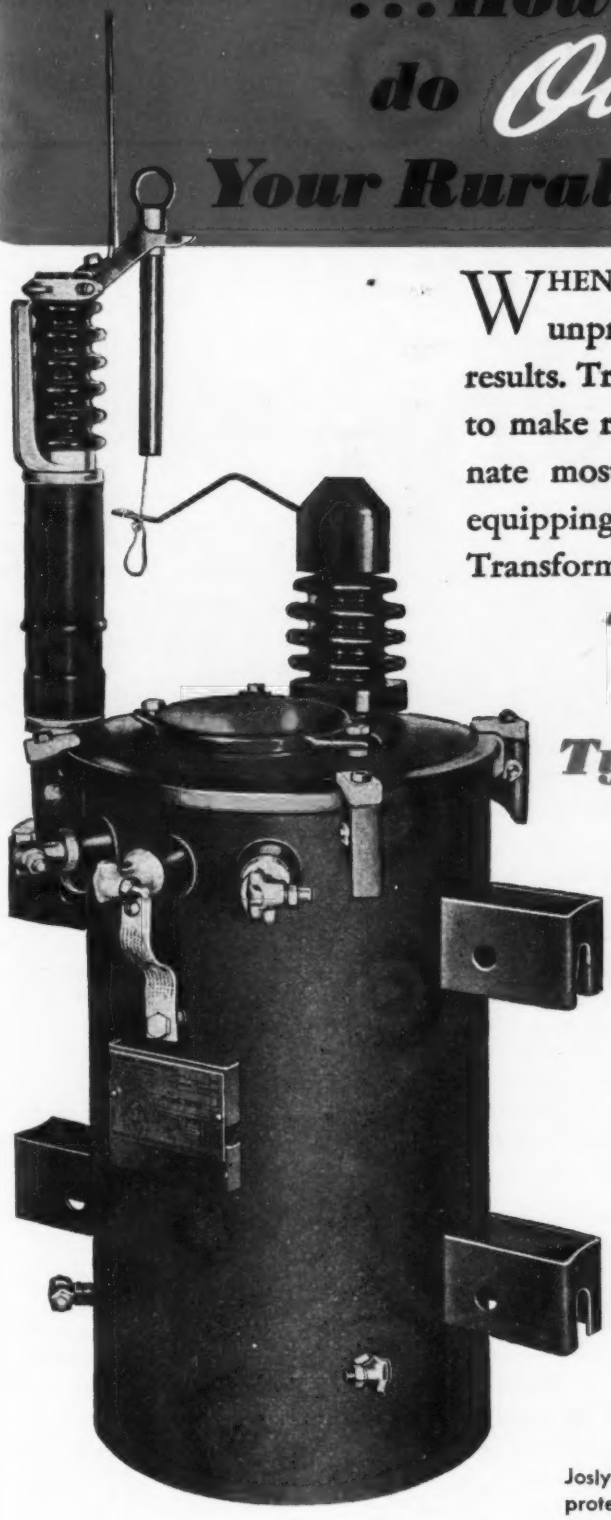
From a paper by P. B. Frost and E. F. H. Gould before the Conférence Internationale des Grands Réseaux Électriques, Paris, June 27-July 6, 1946.

VARIOUS REMEDIAL MEASURES are available for the power system and for the communication system, of which the most promising is the use of gas discharge tubes between lines and earth on the telephone system. They should be so placed that the maximum induced voltage is not more than 300.

Gas discharge tubes should operate instantaneously at a low voltage, but not so low as to risk operation by ringing voltages; they should disconnect the line from earth as soon as the induced voltage ceases, connect and disconnect both legs simultaneously and carry without damage to themselves a current of such magnitude that the whole of the induced voltage is absorbed by the impedance of the line and the tube. The breakdown voltage is not uniform and after prolonged inaction operation is delayed. They appear not to function with the higher-frequency transients with Petersen coils.

Cost of gas discharge tubes is relatively high and their maintenance is a problem, as they usually must be installed at remote points. There is, however, no record of a tube having caused a permanent earth fault after operation.

...How much do Outages cost Your Rural Line Operations?



WHEN lightning strikes rural lines equipped with unprotected transformers, costly maintenance results. Trouble shooters must ride out into the storm to make repairs and this costs money. You can eliminate most of the outages caused by lightning by equipping rural lines with Wagner Protected-Type Transformers.

Wagner

Type HEF-7 Transformers are fully protected

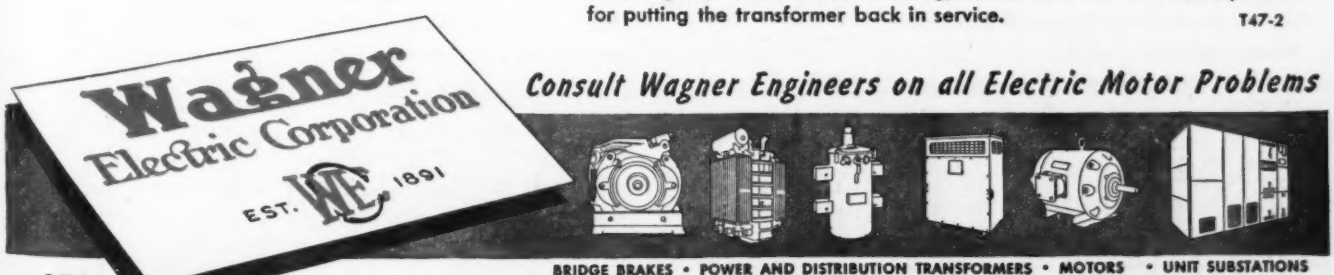
- **Against lightning**
- **Against abnormal load conditions**

These outstanding rural line transformers are amply protected because they are provided with two protective devices:—a Joslyn Lightning Arrestor and a fuse link.

Users of Wagner transformers also profit by our quick, convenient, nationwide service facilities. Wagner manufactures the most complete line of rural transformers. They are fully described and illustrated in Bulletin TU-1C which can be obtained by addressing Wagner Electric Corporation, 6456 Plymouth Avenue, St. Louis 14, Mo.

Wagner Type HEF-7 Rural Line Transformer
Joslyn Lightning Arrestor provides surge protection; primary fuse provides protection against overloads. A blown fuse can be replaced without removing the tank cover or bushing, which reduces the time required for putting the transformer back in service. T47-2

Consult Wagner Engineers on all Electric Motor Problems



T47-2

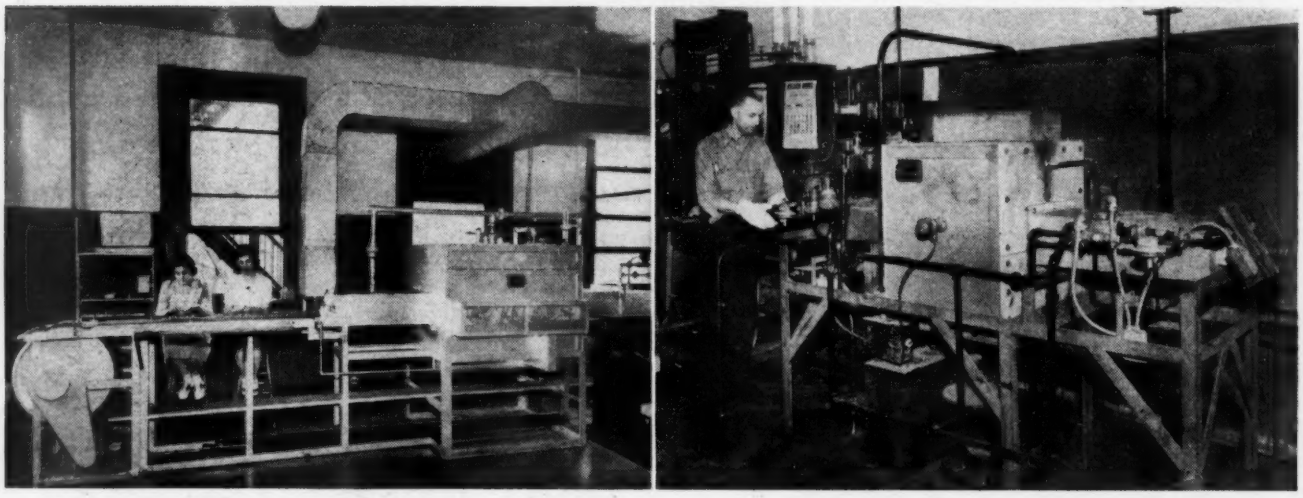
BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL AND AUTOMOTIVE PRODUCTS

LOAD BUILDING

Sintering Furnace Helps to Sell a Brazing Unit

J. R. TAYLOR, Duquesne Light Co., Pittsburgh, Pa.



OPERATORS assemble silver discs and brass studs in trays (left) which move on conveyor belt through continuous brazing furnace. Controlled atmosphere inside furnace prevents oxidation . . . Sintering furnace (right) that helped to sell the brazing furnace

FORMERLY AN OPERATION of welding one piece at a time, production of precious metal contacts in the plant of the Gibson Electric Co., Pittsburgh, Pa., now utilizes a 30-kw. continuous electric brazing furnace. These contacts are used as components of circuit breakers, relays, switches, motor starters and similar electrical devices. The production per hour ranges from 2,000 to 6,000 pieces, depending on size and shape, a tremendous increase over the former method, and a saving of 20 to 30 percent in production cost. A uniformly high quality of production is imperative and this is assured by the even heat distribution of the electric furnace and the precision of its automatic control. Highly satisfactory experience with an 8-kw. sintering furnace used for bonding powdered metals into solid pieces favorably influenced the decision to install the brazing unit.

• • •

Over-All Light Cost at Lowest Level; 14.5% of 1907

LIGHT today costs 14.5 percent as much as it did in 1907. That is the comparison made from the accompanying table, which lists the cost of light per million lumen hours from the time of the introduction of the tungsten lamp in 1907 to today. It includes the increased lamp price which became effective on July 1.

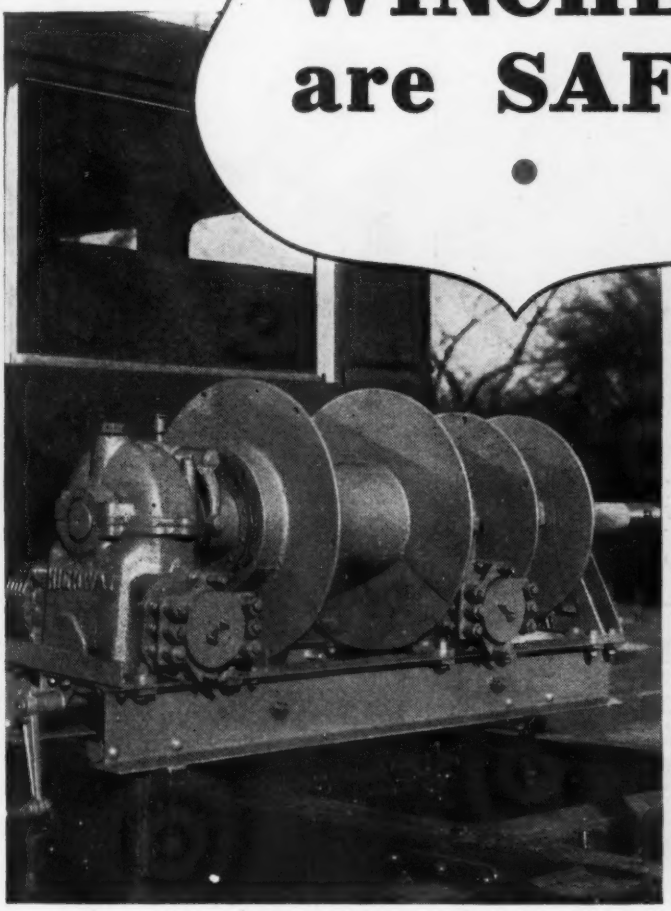
This remarkable decrease in overall light cost was brought about by the utilities and the lamp manufacturers. The utilities' contribution is the energy cost reductions from the $0.105 per kw.-hr. average in 1907 to the $0.0342 in 1946. The lamp manufacturers' contributions were the in-

Reduction In Cost Of Light

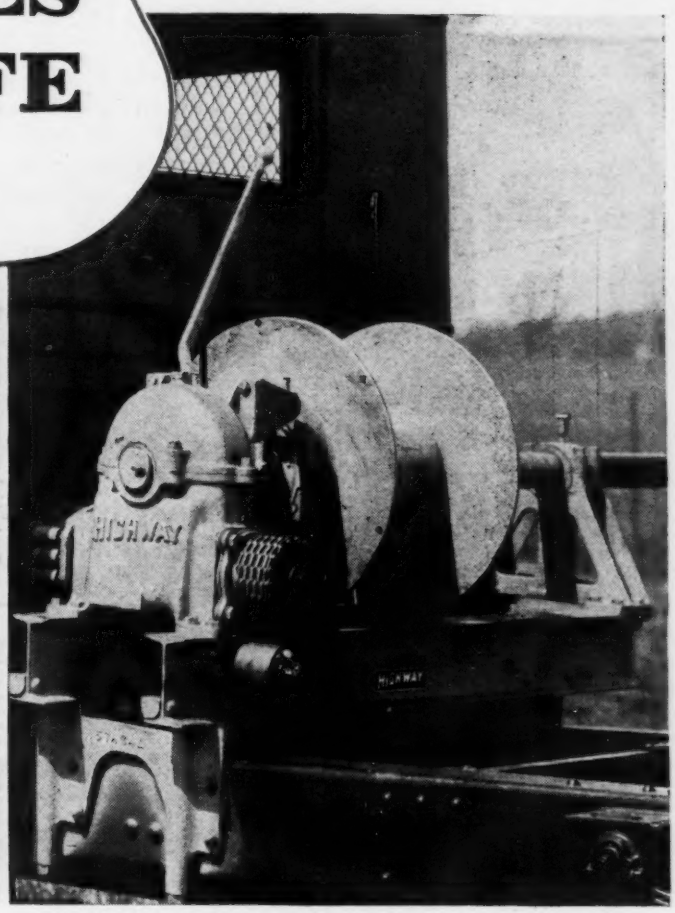
(Based on performance of 60-watt, 115-volt lamps)

YEAR	1907	1927	1932	1937	1940	1943	1946
Initial Efficiency / Lumens Per Watt	7.9	11.2	11.9	13.8	13.9	13.9	13.9
Initial Lumens	474	476	714	828	834	835	835
Percent Lumen Maintenance	91.0	90.0	93.0	95.0	95.0	95.0	95.0
Average Kw.-Hr. Consumed Throughout Life	60.0	59.0	59.0	59.2	59.1	59.1	59.1
Average Energy Cost per Kw.-Hr.	$0.105	$0.068	$0.056	$0.046	$0.039	$0.036	$0.0342
Total Energy Cost per 1,000 Lamp Hours	$6.30	$4.01	$3.29	$2.72	$2.31	$2.13	$2.05
Lamp List Price	$1.75	$0.25	$0.20	$0.15	$0.13	$0.10	$0.11
Total Cost of Light per 1,000 Lamp Hours	$8.05	$4.26	$3.49	$2 87	$2.44	$2.23	$2.16
Cost of Light per million Lumen Hours	$18.68	$7.04	$5.26	$3.65	$3.09	$2.82	$2.71
Cost of Light per MLH in percentage as compared with 1907	100	37.5	28.0	20.0	16.5	15.1	14.5

HIGHWAY WINCHES are SAFE



HIGHWAY MODEL L-12C-6 Double Drum Winch is a dual-purpose unit, 12" drum has spline type clutch, 6" drum is fixed type.



HIGHWAY MODEL L-12C Winch is a small compact unit specially designed for use on 1½ and 2-ton truck chassis.

Perhaps the biggest single recommendation for rugged Highway Winches is the extra measure of *personal safety* which has been engineered into them. They are powerful, certainly. They are dependable, naturally. But men who use Highway Winches have utmost confidence in them because their response is immediate. They pull when you want them to pull. They stop when you want them to stop. They're *safe* for operators.

You'll get the same smooth operation and uncompromising integrity, whether you choose the Highway Double Drum Model L-12C-6 or the small compact Highway L-12C. Both are built to Highway's famous high quality standards. Each delivers superlative performance within the range of loads for which it is designed.

Other famous Highway equipment includes line construction and maintenance bodies, earth boring machines, pole trailers, cable reel trailers and splicer's trailers, all designed for maximum convenience, efficiency, and service. Write us today about your own special requirements.

HIGHWAY TRAILER COMPANY

Manufacturers of: Utility Bodies • Winches • Earth Boring Machines • Pole and Cable Reel Trailers and other Public Utility Equipment.

General Offices: **EDGERTON, WISCONSIN, U.S.A.**

The wide variety of electrical insulating materials offered by the IMC Engineer gives him an objective view toward product improvement that can be of help to you. He, and the IMC organization behind him, are qualified and will...

1. Assist you in the selection of the best insulating material for your job.
2. Familiarize you with its proper application.
3. Suggest ways to eliminate waste.
4. Help to speed up and increase your production.

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CLEVELAND 14, 1231 Superior Ave., N.E.
MILWAUKEE 2, 312 East Wisconsin Ave.

REPRESENTATIVES in: DETROIT 2, 11341 Woodward Ave., MINNEAPOLIS 3, 1208 Harmon Pl., PEORIA 5, 101 Heinz Court, and DAYTON 2, 1315 Mutual Home Building.

creases in the initial lumens per watt output, increases in percent lumen maintenance, and reductions in lamp prices.

The table covers the results of technological advances made in the tungsten lamp as well as the resultant savings to the customer. The 60-watt lamp of 1907 had an initial lumen output of 474, had a 91 percent maintenance throughout life, and cost $18.68 to operate per million lumen hours. In 1946, the initial lumen output had increased to 835, the percent lumen maintenance had risen 4 points to 95 percent. These, with a reduction of $0.0708 in the cost of energy per kw.-hr. and a reduction of $1.64 in the cost of the light source, make possible the sale of light per million lumen hours at $2.71. This is the lowest national average figure for which light has ever been sold and is a reduction of 85.5 percent from the $18.68, 1907 figure.

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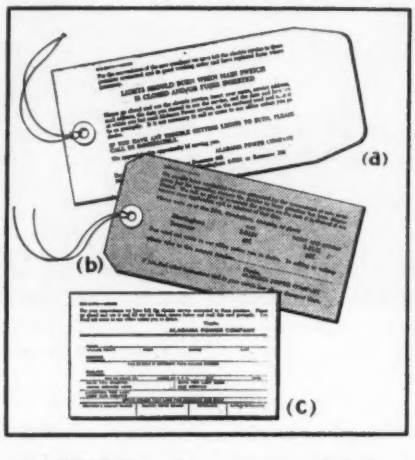
Inactive Services Left "Hot" for New Customers



ENVELOPE with message (a) informs new occupant that electric service is connected. Red tag (b) advises residential service is discontinued and business reply card (c) notifies company of the new customer's identity

A CONVENIENCE has been provided by Alabama Power Co., Birmingham, for new customers moving into residential premises where electric service was established. In such cases it has been decided to try an experiment in which certain services are left "hot" up to the customer's switch during any inactive period, that is, a time between the out-read-

Appliance Manufacturers please note

PRODUCE FOR EXPORT

...not inventory

● Take time to weigh the strong and weak points in your sales outlook and you will see that adjustments are needed to sustain a prolonged period of high activity.

Do not underestimate the coming decline in domestic sales and prices but prepare for it by initiating or expanding your foreign business. Foresight and prompt action will be more important than ever this year.

Remember, profit stays up when volume stays up, so insure your future profits by starting export sales immediately. Strategic placement abroad NOW of limited stocks will keep the sales curve climbing when inventories start accumulating.

Our established contacts with leading overseas distributors insure substantial orders when you need them.

Let us tell you the full story. Write today!

STERN, MORGENTHAU & CO. INC.

44 Whitehall Street New York 4, N. Y.

BARS require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES for ventilated hollow busses have highest rate of heat dissipation, handle greater current density, but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as furnaces of the arc or resistance types.

Flat Bars

for SIMPLICITY, ECONOMY and INEXPENSIVE TAP-OFFS

FLAT BARS require minimum space for making connections to apparatus without the necessity of special joint preparation. The low resistance of the copper and its high thermal conductivity result in low losses and provide an outlet for conducted heat from the apparatus. The bars may easily be bent flatwise or edgewise, or twisted for making the connections.

For heavy currents, due to the large surface area of the laminations, generated heat is readily dissipated. Direct current multi-bar busses have unlimited capacities with adequate copper section and ventilation.

Alternating current busses of flat bars are *limited* in capacity due to unevenness of current distribution in the laminations. 3000 amperes may be considered as the limit of a laminated bus construction for 60 cycles frequency without intricate physical locations of the bars, and without transpositions of the bars.

Anaconda Bus Conductors are available also in four other shapes. Each offers advantages of its own. In addition, because of its high electrical and thermal conductivity, strength, toughness and corrosion resistance, *copper* is recognized as the most satisfactory bus material.

THE AMERICAN BRASS COMPANY
General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

ANACONDA

Anaconda BUS CONDUCTORS

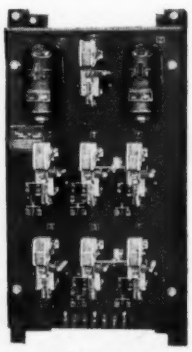
Many Cranes Can Be Controlled to Advantage from the Floor

THIS EC&M Control for **floor-operated** cranes has all the advantages of the well known EC&M Control for **cab-operated** cranes. A single pendant master-station, with two Push Buttons for each motion, makes possible the control of all crane movements. Individual rope-operated Master Switches can be had if desired.

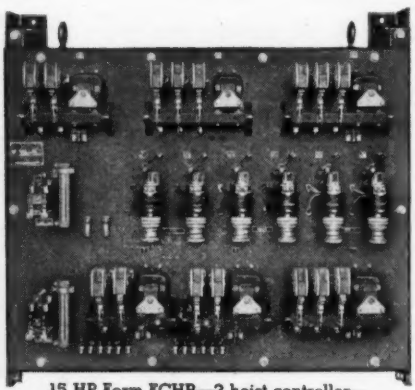
Among the advantages of this standardized line of controllers are (1) accurate inching, (2) compact mounting, and (3) minimum collector-bar requirements. They can be conveniently installed along the crane girders or mounted on the trolley.

Resistors are carefully proportioned for low-torque hoisting of light loads and also provide smooth acceleration for bridge and trolley.

Send for Bulletins 922 (D.C.) and 931 (A.C.) which illustrate and completely describe these units.



Form FCR Controller for trolley or bridge motion —for direct current floor-operated cranes.



15 HP Form FCHR—2 hoist controller—for a.c. floor-operated crane.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO

ing of the meter for the old customer and the in-reading for the new customer.

Actual disconnection of electric service is made by opening the customer's entrance switch instead of disconnecting the lines at the pole. However, the company will continue to disconnect the services at the pole for occasions such as non-payment of bill, removal of meter from premises, or if service has been inactive for 90 days.

Under the plan, an envelope is attached to the customer's service. The envelope has a message (see illustration) and contains a mailing card for information such as customer's name and address, date customer started using service on the premises, the date and location the customer last used the electric utility company's service.

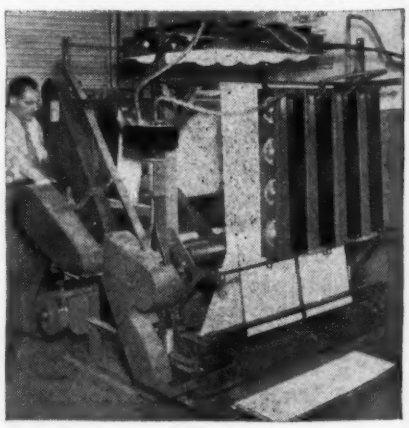
If service is disconnected at the pole, a red tag is placed on the service switch or tied to the front door knob.

The foregoing plan is being tried in the suburban districts, with the idea that if it proves successful it may be expanded to other areas with high customer density.

•

Infrared Applied to Drying Rubber Cement

TO PERMIT the rapid drying of rubber cement on the top stock used principally on volley balls, the W. J. Voit Rubber Co. of Los Angeles designed



INFRARED DRYING MACHINE —This specially designed machine for drying rubber cement on stock used for volley balls takes only four man-hours to do work requiring 48 man-hours under former air drying cycle

Micah is Long-Lived . . .

Micah is long-lived. This perennial juvenile has drunk from the proverbial fountain of youth and eschews vitamin pills and glandular extracts. Gray-bearded old men remember him when *they* were still in swaddling clothes! It's youth! Youth! Youth!

And mica (without the "h") is long-lived, too. Motors and such may wear out, coils and wire may disintegrate, but mica marches on, unchanged by the years. Nothing else lasts as long, nothing else performs as well. There is no substitute for mica. And there is no substitute for *Macallen Mica!*

When You Think of MICA *Think of MACALLEN*

THE MACALLEN COMPANY

16 MACALLEN STREET—BOSTON 27

CHICAGO: 565 W. Washington Blvd. CLEVELAND: 2005 Leader Bldg.

THIS IS A TIME FOR DECISION!

Synthetic or Natural?

Every once in a while a basic decision must be made by every growing industry. The wire and cable industry must make such a decision now. Natural rubber is becoming more plentiful. Is it to resume its former important place in wire and cable insulations? Have synthetic rubber insulations made a place for themselves? How do they compare with those made with natural rubber?

We have attempted to answer these questions in a new "Report to Industry." Available data show that most wires and cables are better with synthetic rubber insulations. We are well pleased with synthetic rubber. Our experience with synthetic rubber during recent years has persuaded us that we can best serve you by using it in the future.

Every user of insulated wires and cables is interested in this subject. If you have not already received a copy of our report, we suggest that you ask for "Our Third Report to Industry on Synthetic Rubber Insulations." In it we have explained our reasons for deciding in favor of synthetic rubber and have included comparative data showing the present relative values of natural and synthetic rubber insulations.

Simplex-WIRES & CABLES

SIMPLEX WIRE & CABLE CO. 79 SIDNEY ST. CAMBRIDGE 39, MASS.

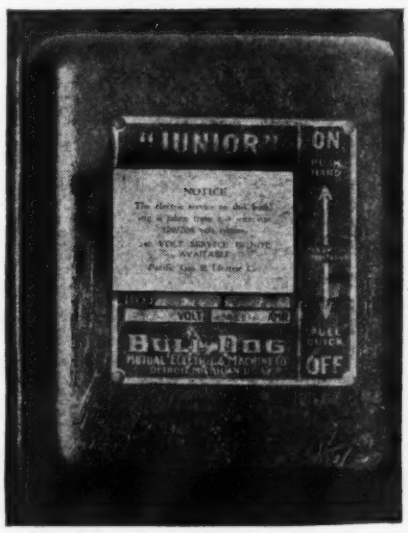
the machine illustrated for use of infrared. Two rolls of the top stock, approximately 18 in. wide, are passed over various steel rolls against a reinforcing canvas. Cement is continuously applied to one side of the stock, which then passes in front of two banks of No. 43-000 Fostoria Even-ray sections containing 32, 250-watt, R-40 infrared lamps.

The stock travels about 15 ft. per min. and requires only 18 sec. under the infrared. One man in four hours can produce all the stock required for a day's operation, whereas, with former air drying, six persons, three each on a two-shift-a-day basis, were needed.

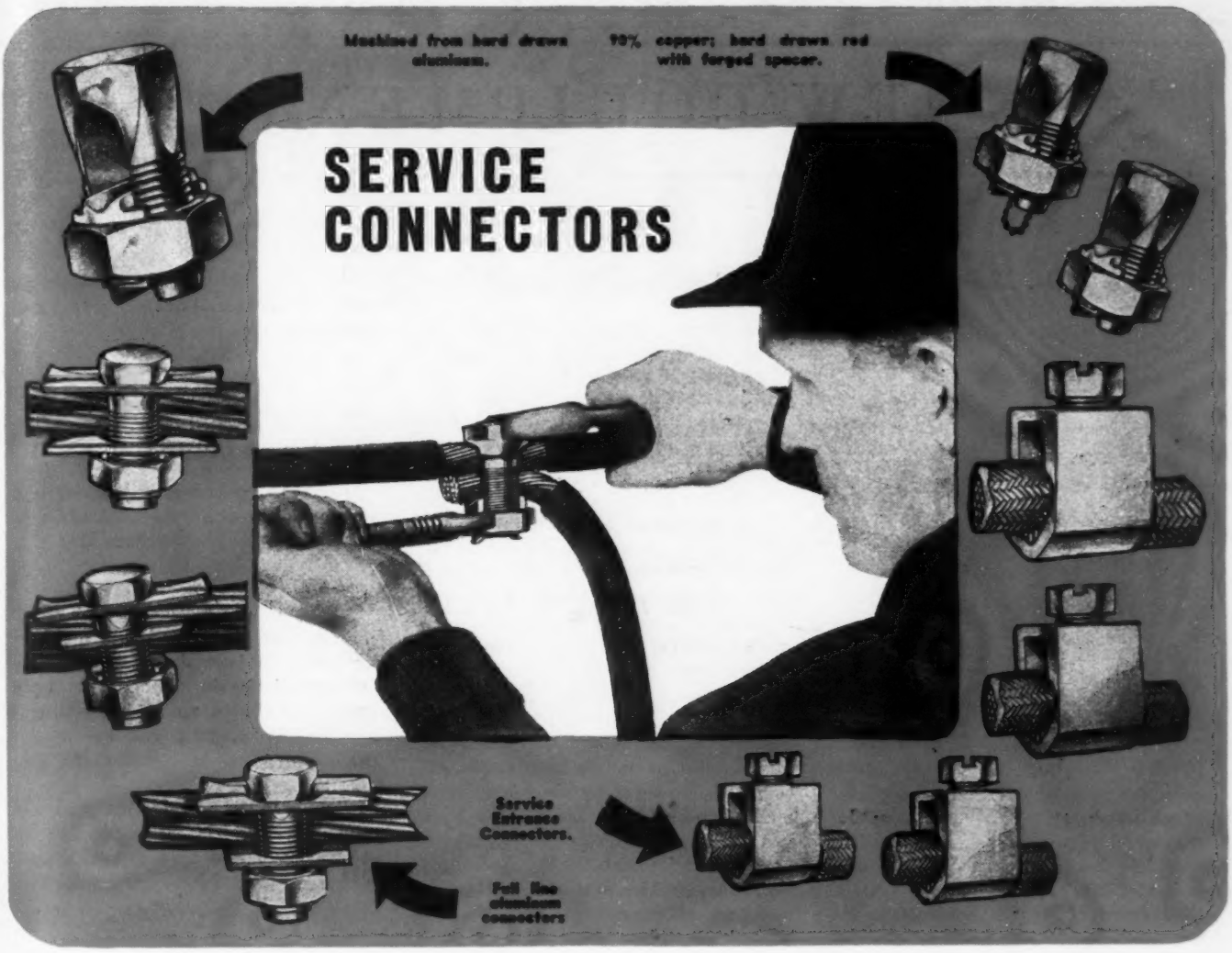
In addition, another application of small infrared units is used, in ½-min. cycles, to dry rubber cement on the halves of the rubber sections of tennis balls before they are cemented together on the outside of the balls, prior to application of the felt covers. The cement on halves of patented rubber valves used in various kinds of sporting balls is also dried in the same manner.

•

Stickers Show Service Voltage



SERVICE VOLTAGE stickers to inform customers and electricians whether a building service is 120/208 or 120/240 volts are used in its Fresno business district by Pacific Gas and Electric Co., at the suggestion of G. J. Gleason. The 2 x 3-in. printed gummed stickers illustrated, by indicating whether service is network or single-phase, should avoid confusion and possible damaging of customers' equipment


Machined from hard drawn aluminum.
98% copper; hard drawn rod with forged spacer.
SERVICE CONNECTORS
Service Entrance Connectors.
Full line aluminum connectors

All Types and Sizes. Yoke-and-Nut Type from No.10 to 1,000,000. Also Service Entrance Connectors Service Post and special connectors, in widest variety.

Penn-Union Service Connectors have accurate machine-cut threads, and carefully chamfered edges — do not catch in lineman's gloves.

Durable—re-usable over and over. Fully approved by the highest authorities in the utility field, for the most exacting service.

Penn-Union also makes a *complete* line of Tee Connectors, Cable Taps; Straight, Parallel, Elbow and Cross Connectors; Bus Supports, Clamps, Spacers; Grounding Clamps, Terminal Lugs, etc., etc.

Leading users have found that "Penn-Union" on a fitting is their best guarantee of Dependability.

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION

Erie, Pa.

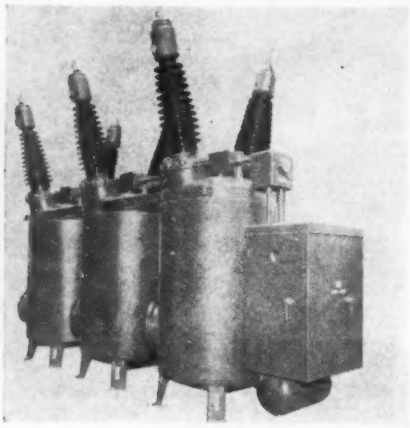
Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

THE Complete LINE OF CONDUCTOR FITTINGS

PENN-UNION

NEW EQUIPMENT

New Oil Blast Circuit Breaker Features Revealed



A NEW high-voltage oil blast circuit breaker featuring completely sealed bushings, a simplified lightweight multi-break interrupter, a pneumatic operating system, and a reduced tank diameter has been announced by General Electric Co., Schenectady 5, N. Y. Designated FK-439, it has voltage ratings of 115 to 230 kv. with interrupting ratings of 2,500 mva. at 115 kv. and 3,500 mva. at 138 to 230 kv.

Bushings on the breaker are of the new, Type F design, which has space for two current transformers on each bushing and permits a total of twelve transformers per breaker. These "F" bushings are completely sealed from the atmosphere, a feature which minimizes maintenance by eliminating deterioration of the internal insulation. It is not necessary to remove the bushings to service the current transformers; they can be drawn over the lower end of the bushings and removed through the manhole in the side of the tank.

Multi-break, interrupter-type contacts of simplified construction are used. These contacts are basically the same for all ratings, although at 230 kv. an additional pair of breaks is used, making a total of six per interrupter at this voltage. A compact parallel resistor, one per interrupter, provides control of overvoltages which accompany interruption of line charging currents.

High-speed reclosing is provided by the pneumatic operating mechanism. The operating unit, with its own air compressor, is completely self-contained. Access to the mechanism and control is provided by the use of three hinged doors in the mechanism housing. Because of the lower control power requirements with pneumatic operation, smaller control batteries and leads are adequate.

Tank sizes have been reduced with a consequent reduction in over-all unit weight and oil content. Leg-type tank supports facilitate inspection and painting under the tank. Large side manhole openings provide access to the interior of the tank for maintenance. These manholes are of sufficient size to permit removal of the interrupter contacts and the current transformer.

A bushing potential device of improved design provides a source of energy for the operation of relays, voltmeters, and synchroscopes.

•

Glove Carrier, Electrician's Belt Added to Line

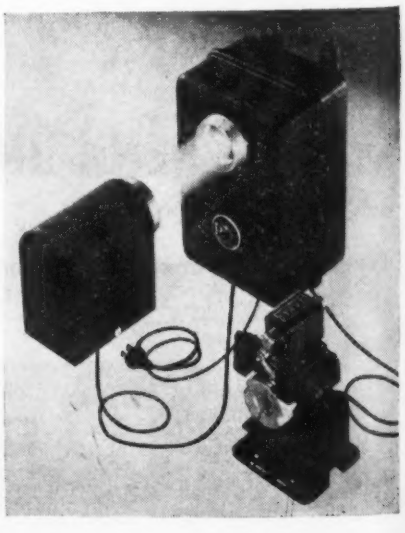
A CANVAS rubber glove carrier and an electrician's belt have been added to their line by the Buckingham Mfg. Co., Inc., 7 Travis Ave., Binghamton, N. Y. The glove carrier or bag is made of 8/0, vat-dyed, olive-drab duck, with the front, bottom, back and flap made of one piece. It is equipped with a snap for convenience in attaching to body belts. It is designated as No. 400, is 8 in. wide, 15 in. long, and has an expansion of 2¾ in. at the top and bottom.

The electrician's belt is made of brown mechanical leather, is 1½ in. wide, has a latigo tape holder, a snap and tool lopp, and is of light weight.

•

Photoelectric Counter Becomes Packaged Item

A COMPLETELY PACKAGED, easily installed, general-purpose photoelectric counter has been announced by Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass. It is known as type P1 and consists of a photoelectric control, light source, and an electric counter. Remote indication can be easily obtained



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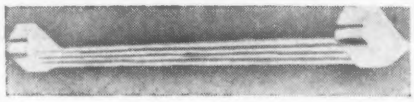
New Slim Fluorescent Has 10,000-Hr. Life Rating

PRODUCTION of a new Slim fluorescent lamp with a rated life of 10,000 hours has begun at the Duro Test Corp., North Bergen, N. J. The new lamp is of the hot cathode type that starts cold instantly. It has an efficiency which is reported equal to that of the preheat hot cathode type.

The design was made possible, the company states, by a new company developed cathode which is 16 times heavier than the preheat cathode and holds 10 times more emission coating. It is manufactured in standard 8-ft.



lengths and when used with the company's ballast is rated at 35 watts, 120 milliamperes. The lamps are equipped with push type contact bases which are easily inserted in the new type spring-tension sockets.

It is available in all standard colors. The lamp is so designed that it will operate on 100, 120, and 200 milliamperes consuming approximately 30, 35 and 50 watts respectively, and consequently having various levels of light output and brightness.

ANNOUNCING HUBEYE!

The Answer to Guying Requirements

End view showing Side Wall Support of Strand by Hubeye design.

Side view showing lay of Strand in Hubeye. Fully Rounded Bearing Area is provided.

After many years of experience in producing forged eyes of all types for use without thimbles, Hubbard and Company has developed and established as its standard, the HUBEYE. This eye has received immediate approval from all Standards Engineers to whom it has been shown. Due to its universal appeal Hubbard and Company has concentrated on this design as standard for all eyes on products which involve attachments where a no-thimble eye means a saving of time, money and maintenance to users. Most of these items are illustrated or listed here.

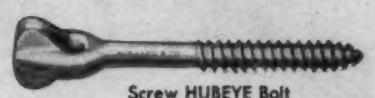
Hubeye design consists of a rounded section of large radius around which the guy is looped. High side walls support and maintain its round shape so that no individual wire strands are subjected to excessive strain. The eye is drop forged and is stronger than the rod section from which it is made. All inner surfaces are kept smooth and are protected against corrosion by Hubbard Double-Dip Hot Galvanizing.

HUBEYE Anchor Rod Threaded or Drive Point and Screw Type Steel-wing.

TU-HUBEYE Anchor Rod Threaded or Drive Point

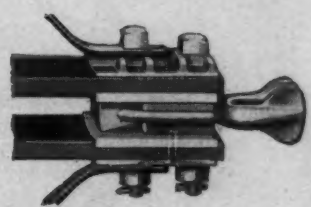
HUBEYE Straight Bolt

HUBEYE Angle Bolt



Screw HUBEYE Bolt

HUBEYE NUT (Threaded)



Wood Strain Insulator HUBEYE Attachment

HUBBARD and COMPANY

Pittsburgh · Chicago · Oakland, Calif.

KLEINS

FOR MEN WHO WANT THE BEST

Every good workman appreciates high quality in the tools and equipment he uses. To a lineman, however, this regard for quality is more than admiration for fine craftsmanship. The lineman daily trusts his very life to his safety strap, belt and climbers—and under such conditions high quality is more than a matter of pride.

Good workmen know that there's no substitute for experience. It is the years of expert craftsmanship back of every piece of Klein equipment that make Klein belts and safety straps—Klein climbers and grips—Klein pliers and wrenches the first choice of linemen today as they have been "since 1857."

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

This book on the care and safe use of tools will be sent on request.

Since 1857

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO

since only the control and light source need to be installed at the point-of-count.

Installation has been simplified as far as possible, the company reports. The control has a line cord with a male plug connection which fits any standard outlet. This supplies power for the light source and the electric counter, which in turn have cables and plugs for plug-in connection to the control. The entire combination of equipment can be installed without the help of an electrician, the company adds.

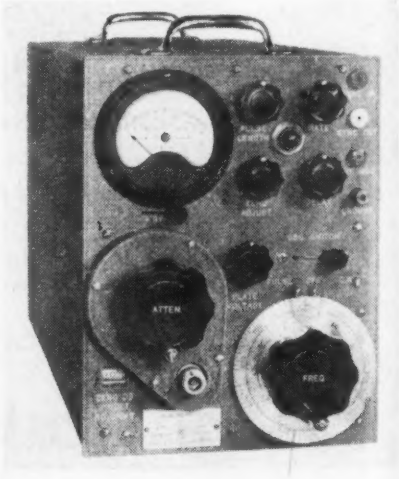
It is designed with a speed of operation up to 600 counts per minute, an operating range of 6 ft. between photoelectric unit and light source, and a maximum count of 99,999 before returning to zero. The counter may be returned to zero at any time by turning reset knob.

•

UHF Signal Generator Has Post-War Refinements

MODEL 61A signal generator, a compact source of UHF current for general laboratory use, has been announced by Hewlett-Packard Co., Palo Alto, Calif. Within its frequency range of 500 to 1,350 mc., it is designed for a laboratory standard in determining gain or alignment, obtaining antenna data or measuring standing wave ratios; for reading single-stage or conversion gain, signal-to-noise ratios, circuit "Q," or transmission line characteristics.

This instrument is reported unusually stable, and over its frequency range will supply voltages ranging from 0.1 microvolt to 0.1 volt. R-f output may be continuous, amplitude modulated, pulsed, or square-wave modulated. Pulse length can be readily controlled between 2 and 50 microseconds, and pulse rate is variable from 60 to 3,000 times per second. The instrument includes post-war refinements and a simplified direct-reading control system. Operating charts are not necessary.



CATALOGS and BULLETINS

A monthly digest of recent manufacturers' literature compiled by Electrical World for your convenience in securing without obligation the most recent information on electrical and allied products.

CHECK ON COUPON BULLETINS DESIRED AND MAIL TO US. WE WILL FORWARD REQUESTS TO MANUFACTURERS

1 HEATING AND DRYING SYSTEMS: Two folders, convenient for filing away in desk drawer, contain information on heating and drying systems designed for industrial application. Illustrations showing actual installations of these systems are given. Heat Generating Systems Inc.

2 METERS: Bulletin 151 describes and illustrates measuring instrument used for recording the percentage of oxygen or excess air in a gaseous mixture. Some applications where this instrument is used are in boiler furnaces, lime kilns, cement kilns, glass tanks, chemical processes, etc. Graphs and drawings are included. Bailey Meter Co.

3 VARIABLE AUTO-TRANSFORMER: Bulletin No. 149A features a variable auto-transformer used in obtaining a continuously variable output voltage from a.c. power lines. This equipment is adaptable to any application where a smooth continuously adjustable output voltage is required. Illustrations, wiring diagrams and tables are given. Superior Electric Co.

4 LAMPS AND ACCESSORIES: Catalog lists a comprehensive line of manufacturer's items such as fluorescent lamps, insect-repellent lamps, fluorescent starters, plug fuses, cartridge fuses, dry batteries, and germicidal lamps. Illustrations and tables containing pertinent data concerning each item are given. Solar Electric Corp.

5 ELECTRIC HOISTS: Bulletin H20-2 features a variety of electric hoists designed for overhead materials handling tasks in machine shops, assembly departments, store-rooms, warehouses, loading zones, etc. Illustrations showing equipment in operation are given. Engineering data, as well as open-view photographs of product, are also given. Condensed specifications and clearance data tables are included. Harnischfeger Corp.

6 MOLDING MATERIALS: A handbook on the injection and extrusion of molding thermoplastics. Contains technical information on the range of properties and variety of formulations of these molding materials. Graphs, drawings and tables are furnished. Celanese Plastics Corp.

7 MOTORS: Bulletin E100 E, titled the "Catechism of Electrical Machinery," presents in a simple way the theoretical and practical aspects of the common types of direct-current and alternating-current motors, generators, and control equipment. Illustrations and wiring diagrams are given. Fairbanks, Morse & Co.

8 INSULATION TESTING INSTRUMENTS: Bulletin 1720 features a variety of "Megger" ground testers used for measuring earth resistivity. Other types of testing equipment are also illustrated. James G. Biddle Co.

9 FRICTION TAPE: Catalog section 9270 features a two-in-one type of rubber tape friction used in weather-sealing electrical splices in one operation. Product possesses double-purpose features—combining the insulating properties of splicing compound with the tensile strength of friction tape. The B. F. Goodrich Co.

10 CABLE JOINTS: Bulletin CJ3 discusses various methods of designing and handling cable joints for paper-insulated, lead-covered cables, preferably the single-conductor and multiple-conductor belted type. Bulletin covers standard two-way joints, and is published as a convenience in ordering splicing kits for the most commonly used types and sizes of cables. Diagrammatical drawings and tables are included. G & W Electric Specialty Co.

11 INSULATORS: Publication No. 800-H features a line of low-voltage pin-type insulators designed for distribution and farm lines. Dimensional drawings for each type are furnished. Included also are technical data. Ohio Brass Co.

12 FLUORESCENT LIGHTING: Pull-out folder discusses type of fluorescent "in-bilt" lighting installations designed to meet good lighting practices. Units are described and illustrated with typical continuous installation, showing methods used in installing equipment. Engineering data are also given. Holophane Co., Inc.

13 FLUORESCENT LIGHTING ACCESSORIES: Folder features accessories used in fluorescent lighting installations. Includes illustrations of lampholders, starters, switches and cord sets. Technical data are also included. General Electric Co.

Circle numbers, sign and mail *Coupon good until April 1, 1947 only*

February 1, 1947

ELECTRICAL WORLD
330 West 42nd Street, New York 18, N. Y.

Please send me, without obligation, manufacturers' literature herein described and identified by numbers circled below:

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This coupon, properly filled in, is referred to the manufacturers for handling. Electrical World serves as a clearing house for this service.

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NEWS ABOUT PEOPLE

Delaware Power Elects Two Additional Vice-Presidents

Directors of the Delaware Power & Light Co., Wilmington, Del., have elected two additional vice-presidents of the company, H. H. Plank and Austin T. Gardner.

Except for two years' service in the Army during World War I, Mr. Plank has been engaged in public utility work since leaving college in 1917. He joined the Delaware Power organization in 1943 and since 1944 has held the position of assistant general manager. Prior to going to Wilmington, he was associated for many years with the United Gas Improvement Co. in Philadelphia.

Mr. Gardner became identified with the Delaware properties in 1943 and early the following year was elected

H. H. PLANK

secretary and comptroller. In addition to his new duties as vice-president, Mr. Gardner will continue as secretary of the company. He has been active in the utility industry since his graduation from the School of Business Administration of the University of Chicago, serving successively the Utilities Power & Light Corp., Chicago, Utility Auditors and Tax Consultants, the Utilities Management Corp. During his employment by the last named company, he participated in many utility proceedings before the Securities & Exchange Commission, the Federal Power Commission and various state regulatory commissions. From 1941 to 1943, when he

A. T. GARDNER

went to Delaware, he was assistant to the president of the Associated Electric Co. of New York.

•

▶ JOSEPH W. KLING, who has been in the advertising department of Georgia Power Co. for the past 16 years, has been appointed acting advertising manager to succeed JAMES M. STAFFORD, JR., who recently resigned to become director of advertising and publicity for the United Light & Railways Co. of Kansas City, Mo. A native of Atlanta, Mr. Kling graduated from the University of Georgia in 1924 and joined the editorial staff of the *Atlanta Journal.* In 1930 he affiliated himself with the advertising staff of Georgia Power and became editor of "Two Bells" and of the company's employee magazine. Recently his advertisements of the company's transportation department were awarded first prize in the P.U.A.A. national better copy contest.

▶ ROBERT A. MITCHELL, sales promotion and advertising manager of the Louisiana Power & Light Co., New Orleans, has severed his connection with the company to devote his time to personal business interests, chief among which is the Louisiana Transit Co., which he helped to organize and which he will now operate as general manager. Mr. Mitchell had been identified with the Louisiana utility since 1929 and served as sales promotion and advertising manager since 1941.

Deardorff, Stuart Made Vice-Presidents in Dayton

Announcement has been made of the election of Harold E. Deardorff and James M. Stuart to vice-presidencies in the Dayton Power & Light Co., Dayton, Ohio. Both officials will continue to administer their present duties, Mr. Deardorff as supervisor of system planning engineering and Mr. Stuart as manager of the electric division.

Mr. Deardorff has been associated

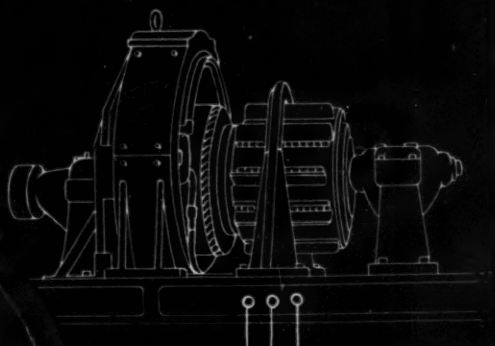
H. E. DEARDORFF

with the Dayton utility since his student days at the University of Cincinnati and after taking a permanent position,

J. M. STUART

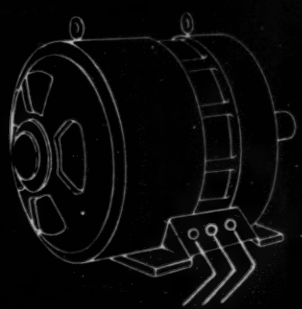
following graduation in 1922, he progressed steadily through the company ranks. In 1940 he was made supervisor

FERRANTI 7-RANGE CLIP-ON VOLT AMMETER



FOR GENERATORS

FOR
TRANSFORMERS



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0-150 TO 0-600 VOLTS

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Silicone News

DC

DC Silicone Insulation Insures Motor Life!

Photo courtesy Automatic Transportation Company.

It's human nature to want to beat the drums a bit when something you've put your sweat and capital into for years begins to pan out. We've been developing Silicone Insulation for years and giving silicone insulated motors the toughest testing electrical engineers could devise. We know it's the best electrical insulation there is. That confidence is now being justified.

Automatic Transportation Company of Chicago has announced that all of their new industrial trucks will be powered by DC Silicone insulated motors and lubricated with DC Silicone grease. That means a lot to us—and to you too. Engineers estimate that 20 to 50% of manufacturing costs goes into material handling. It costs you about $300, for example, to have a truck out of service while an armature is rewound.

Automatic Transportation is taking out insurance against such losses for you, by using Silicone Insulation. That kind of insurance is really necessary because there is no control over the kind of service industrial trucks get. They may have to lift 1,500 or 35,000 pounds. They may be used constantly or only part time. They may run over smooth floors or rough ones. A 2% grade doubles the torque on the motors.

That's why Automatic uses the best insulation there is. They put the best grease they can buy in the bearings. That's the DC 44 silicone grease, because it won't bleed into the windings or brushes. They also cushion the solenoid coils with Silastic*. Taken altogether, it's a nice example of how a conscientious, enterprising company can improve its product by using Dow Corning Silicones. These heat-stable, water-proof materials are described in Catalog No. L 1-4.

*TRADE MARK, DOW CORNING CORPORATION

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Chicago: 228 N. La Salle St.
Cleveland: Terminal Tower
Los Angeles: 634 S. Spring St.
New York: Empire State Bldg.
In Canada: Fiberglas Canada Ltd., Toronto
In England: Albright and Wilson, Ltd., London

Dow Corning
FIRST IN SILICONES

of system planning engineering. He is a member of the American Institute of Electrical Engineers, of the electrical equipment committee of the Edison Electric Institute and of other engineering societies.

Mr. Stuart became identified with the Dayton properties in 1923. He has held the position of clerk in the line department, foreman in the underground department, assistant supervisor and supervisor of underground and in 1942 was made manager of the electric division.

•

New Assignments Made by Kuhlman Electric Co.

H. E. Greenwalt has been appointed production manager of the Kuhlman Electric Co., Bay City, Mich. Mr. Greenwalt has been a well known figure in the electrical power equipment field for nearly a quarter-century. Prior to joining Kuhlman he served 22 years with the Standard Transformer Co., Warren, Ohio, the last 19 of which he held the position of production manager.

Kuhlman also announced the change in corporate officers of W. S. McNab from secretary to vice-president and treasurer, and the appointment of G. R. Fluehr, treasurer for the past seven year, as vice-president and secretary. Both men are members of the Kuhlman operating committee.

•

► WALTER EVANS, vice-president in charge of all radio activities for the Westinghouse Electric Corp., has been awarded the Army Certificate of Appreciation for "his contribution to the Signal Corps in connection with the development and production of radio and radar equipment during World War II."

► ROY A. BRADT, vice-president in charge of sales, service and advertising of the Maytag Co., Newton, Iowa, has been elected president of the American Washer and Ironer Manufacturers Association. He has been a member of the association's executive committee for six years. Mr. Bradt is a past-president of Maytag Co., Ltd., of Canada.

► E. M. RAUN has been appointed assistant general manager of the Sioux City (Iowa) Gas & Electric Co. Mr. Raun had been general superintendent of production. His new duties will relate to operating matters. He will be succeeded as general superintendent of production by WARREN KANE.

Miller Named Engineering Vice-President by Weston

Weston Electrical Instrument Corp., Newark, N. J., has announced the appointment of John H. Miller as vice-president and chief engineer. He succeeds W. N. Goodwin, Jr., who, although retired, has been retained as an engineering consultant.

Mr. Miller obtained his early engineering experience at Westinghouse and after serving in the Signal Corps staff office in Washington, D. C., on special radio developments for aircraft during World War I, he spent the next twelve years as chief engineer of the Jewell Electrical Instrument Co., Chicago, and the last four years of this period also as vice-president. During this time, he developed a complete line of electrical

J. H. MILLER

indicating instruments and test sets and methods for servicing radio receivers and testing vacuum tubes. It was while he was with Jewell that he and two other engineers formed a Chicago section of the I.R.E., and he served terms as chairman and secretary of this group. He also was a member of the board of the Western Society of Engineers.

When the Jewell company merged with Weston in 1931, Mr. Miller transferred his interest to the East to become assistant chief engineer. In 1937 he took charge of the commercial engineering division, which he continued to manage until he was appointed chief engineer in 1944.

In addition to being active in the Institute of Radio Engineers, Mr. Miller has participated for many years in the affairs of the American Institute of Electrical Engineers, of which he is a fellow.

•

► RICHARD P. HILL, manager of sales for the northeast division of the Arkansas Power & Light Co. in Searcy, has been named sales promotion manager

for the company. He is succeeded at Searcy by HARRY HOFFMAN, Ozark division sales manager, who is now handling both Ozark and Northeast divisions out of Searcy.

•

Sylvania Electric Elects Two New Vice-Presidents

Robert H. Bishop, director of sales, and Conda P. Boggs, director of manufacturing, have been elected vice-presi-

R. H. BISHOP

dents of Sylvania Electric Products Inc.

Mr. Bishop joined the company as a member of its New England sales force in 1936. He subsequently became New England district manager, eastern sales manager and in 1943 general sales manager for all of the company's lighting products. In April of this year he was

C. P. BOGGS

appointed director of sales for the entire company.

Mr. Boggs, who has been associated with General Electric and R.C.A., joined Sylvania Electric in 1932. After special assignments in connection with costs and planning, he became assist-

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WITH **SIL-FOS** AND **EASY-FLO**

By preplacing these low-temperature silver brazing alloys and using fast handling and heating methods, metal joining with SIL-FOS and EASY-FLO has become a fast, low-cost mass production operation on hundreds of jobs. Also, the ability of these alloys to join stampings and tubular parts with one-piece strength has revolutionized the design of many products* with big savings in production costs. Find out what SIL-FOS and EASY-FLO can do for you. Write today for BULLETINS giving full facts — including details about the new faster acting, lower cost, EASY-FLO 45.

*A Typical Example

ELECTRIC IMMERSION HEATERS made by Edwin L. Wiegand Co., Pittsburgh, Pa. With the simple set-up shown, formed copper tubes are brazed to copper-clad steel flanges. Operator slips EASY-FLO rings on tube ends, inserts ends in flange, places assembly in fixture and applies Handy Flux. Meanwhile, an assembly in induction coil is brazed and a third is cooling. Result—a steady stream of 100% water-tight heaters at low cost.

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*COLOVOLT

Cold Cathode—Low Voltage Lighting

and here's what they say:

"Lower maintenance cost—longer maintenance of a given foot-candle level—greater dependability because of guarantee (One year of light guaranteed, except for failure due to breakage)—instantaneous starting—no flickering—continuous line lighting." These extra advantages are available to commercial and industrial users of light when installations are made with COLOVOLT Cold Cathode, Low Voltage Fluorescent Lamps and Fixtures.

Write for illustrated material and technical data.

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GENERAL LUMINESCENT CORPORATION
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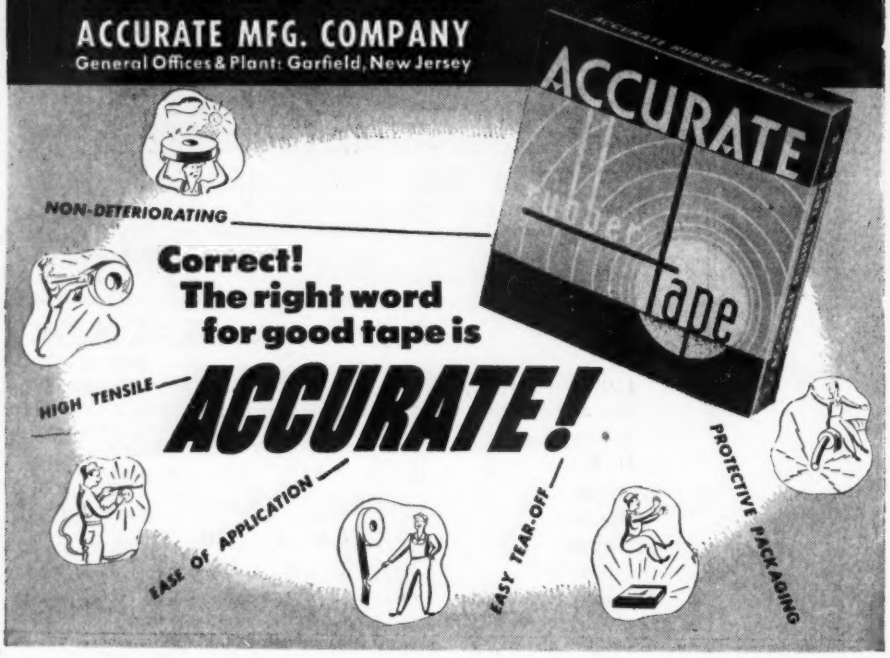
IT'S ACCURATE!

...for tapes that work with you on the job!

ACCURATE is the kind of tape you'll like to work with. Break open a box on the job . . . note that fresh, clean smell . . . it means tape that's fresh and tacky! Prove it to yourself—apply it to a joint and start taping. See how the tape takes hold on the first turn, doesn't pop off the joint or creep. Tape up hard—ACCURATE tapes can "take it" and give you tight, smooth jobs without splitting or raveling.

When you've finished the joint, see how clean and easy the tape tears off—no loose threads. Yes, you'll find that ACCURATE tapes . . . friction and rubber . . . *do* work with you on the job. So next time you buy tape, try ACCURATE—available in convenient sizes everywhere.

ACCURATE MFG. COMPANY
General Offices & Plant: Garfield, New Jersey



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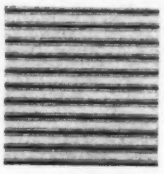

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A one piece heavy duty cable tap. No loose pieces. Cables readily inserted from end or sides as illustrated. *For complete listing of Power connectors send for Catalog 45.*

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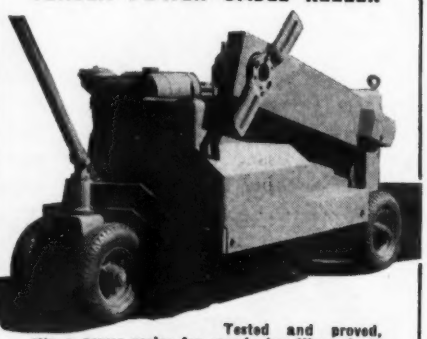
JENSEN POWER CABLE REELER



Tested and proved, it's a power reeler for speedy handling of all sizes, all types of cables and reels. For further facts, write Harry M. Jensen and Company, 5468 W. Potomac Avenue, Chicago, 51, Illinois.

HARRY M. JENSEN & CO. CHICAGO

ant to the executive vice-president in 1940, and was appointed director of manufacturing in 1942.

•

▶ HERBERT METZ has been appointed a member of the executive committee of the Graybar Electric Co. and at the same time was named eastern district manager at New York, succeeding W. J. DRURY in both these capacities. Mr. Drury is retiring after more than 42 years of company service. Mr. Metz has been associated continuously with Western Electric and Graybar since 1914. For many years he has been active in the electrical industry's representative associations. When the Adequate Wiring Bureau was launched in 1938, he was made chairman of the planning committee and in 1941 he was elected chairman of the executive committee, the duties of which office he has just relinquished. Last year he was awarded the 1945 Electrical Wholesalers Medal and Purse given under the James H. McGraw Award.

▶ DR. WILLARD E. HERRING, Rural Electrification Administration's oldest staff member in point of service, has announced his retirement from federal service to enter business for himself as a consulting engineer in Chattanooga. Dr. Herring was employed by Morris L. Cooke, first REA administrator, when the agency opened offices in Washington on May 11, 1935. He subsequently served as chief engineer, liaison officer, director of operations and special consultant to the administrator. He held the position of consulting engineer at the time of his retirement.

▶ DR. W. R. G. BAKER, General Electric vice-president in charge of the company's electronics department, has been awarded the Army Certificate of Appreciation for "patriotic services in a position of trust and responsibility . . . for outstanding contribution to the war effort by the development, design and production of complex Signal Corps radio and radar equipment."

▶ ARTHUR MARKS, director of A. B. Metal Products Ltd., has arrived in this country from Great Britain on the *S.S. America* to study production methods at the factory of the Oak Manufacturing Co. for whom A. B. Metals are licensees in Great Britain. Mr. Marks will also arrange manufacturing rights for American electrical products in England.

▶ SAMUEL INSULL, JR., has been appointed assistant to James S. Knowlson, chairman of the board and president of Stewart-Warner Corp., Chicago. Since his return from military service

in 1945, Mr. Insull has been vice-president of Central Barge Co., Chicago. He was engaged in the utility business from 1922 to 1938.

OBITUARY

J. Leo Scanlon

J. Leo Scanlon, president of the J. Leo Scanlon Electrical Equipment Co., Buffalo, and two midwestern utilities, whose death was announced in the January 25 issue of ELECTRICAL WORLD, page 12, was born in Iowa City 55 years ago. A graduate of the University of Iowa, Mr. Scanlon went to Buffalo 25 years ago and in 1923 founded the electrical firm which bears his name. His early experience was obtained with the Moloney Electric Co.,

St. Louis, which he joined, following military service in World War I, in the capacity of salesman, subsequently being promoted to the sales managership.

He entered the utility field in 1942, when he acquired controlling interest in the Iowa Water Service Co., Iowa City, serving as its president. Early in 1945, Mr. Scanlon purchased all the outstanding securities of the Missouri Service Co., Tarkio, Mo., from the Engineers Public Service Co. and also became president of that utility.

Mr. Scanlon was a member of the American Institute of Electrical Engineers, the Association of Iron and Steel Engineers and the New York State Society of Professional Engineers.

•

▶ NEAL W. BURDETTE, since 1937 superintendent of the Lancaster, Ohio, district of the Ohio Power Co., died of a heart attack in his office on December 27. He was 52 years old. Mr. Burdette had been with the Ohio Power Co. since 1913, previously serving in Newark, Fostoria and Canton.

▶ GEORGE H. WISTING, vice-president of the Columbia Aircraft Industries and formerly assistant general manager, Northwestern Electric Co., Portland, Ore., died of a heart attack in Hollywood, Calif. He was born in Muskegon, Mich., 52 years ago. Mr. Wisting, who was well known in the electrical industry, left Northwestern Electric in 1942, where he was serving in the capacity of assistant general manager, to assist in the organization of the Columbia Aircraft Industries. While in the utility field he was active in the Northwest Electric Light and Power Association.

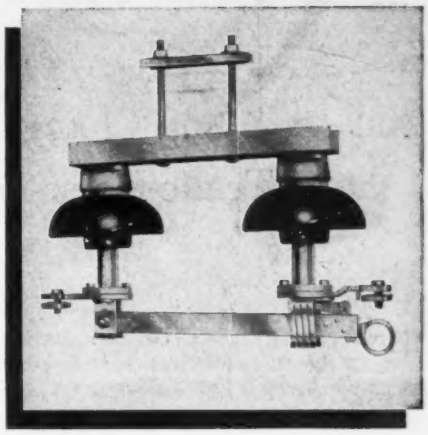
▶ OTTO A. KNOPP, who retired as head of the Pacific Gas & Electric Co.'s bureau of tests and inspection in 1942, died on December 19 in Oakland, Calif. He was 79 years old. Mr. Knopp was born in Berlin, Germany, in 1877. In 1901 he came to New York and soon joined the General Electric staff at Schenectady. Subsequently he went to San Francisco, becoming design engineer for the California Gas & Electric Co. in 1903. When that utility became the P. G. & E. in 1905, Mr. Knopp was assigned to Oakland to organize a meter test department which later developed into the bureau which he headed until his retirement. At the time of his death, he was serving as consulting engineer and as a director of the Gardner Electric Manufacturing Co. and of Electrical Facilities, Inc., an organization set up to manufacture his inventions. He held more than 40 patents on electrical equipment, much of which is now in general use in the utility field. Mr. Knopp was a member of the American Institute of Electrical Engineers, the Pacific Coast Electrical Association and the Engineers Club of San Francisco.

▶ BEN P. BAILEY, industrial engineer, whose long career with Pacific Power & Light Co. included managerships at The Dalles, Astoria and Yakima, died on December 23 in Portland after several weeks' illness. He was one of the members of the original staff at the time of the company's formation in 1910. A native of Humboldt, Neb., Mr. Bailey was 66 years old.

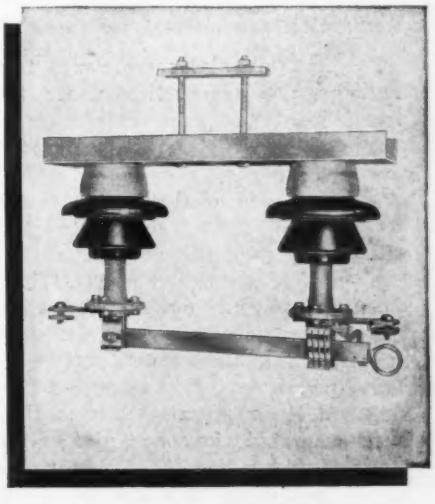
▶ R. J. WORDEN, superintendent of station maintenance for the western division of the Ontario Hydro-Electric Power Commission, died in London, Ont., on December 26. Mr. Worden was born in Adams Centre, N. Y., 59 years ago.

▶ DR. ROBERT J. MOORE, technical coordinator of the Bakelite Corp., New York, and an authority on the chemistry of modern plastics, died at his home in Montclair, N. J., on January 6 after a heart attack. He was 54 years old.

MATTHEWS DISCONNECTING SWITCHES



Available in ratings of 7.5, 15 and 23 KV., 200 and 400 amperes. These hook operated switches are well constructed and have large blades and positive contacts which prevents any overheating at full rated load. All 200 ampere rated switches are furnished with single blades while the 400 ampere switches have double blades and can be supplied with or without blade latches. They are adaptable for horizontal or vertical mounting and can also be supplied with NEMA rated insulators as shown below.



Write for Bulletin 106

W. N. MATTHEWS CORP.
3722 FOREST PARK BLVD.
ST. LOUIS 8, MO.

MANUFACTURERS & MARKETS

Far-Reaching Change in American Trade-Mark Law Effective July, 1947

Trade-mark registration will become a "practical necessity" when the Lanham Act becomes law next July, according to the Research Institute of America, which has just issued a 56-page analysis, "Preparing for the New Trade-Mark Law."

"While the Lanham Act will offer trade-mark owners unprecedented protection against encroachment," the Institute points out, "trade-marks registered under earlier laws will not automatically receive all the benefits of the Act. For example, trade-mark owners whose marks are registered under the Acts of 1905 or 1881 must have their marks republished on the Principal Register if they want the benefit of the incontestability provisions of the new law."

Since a mark will not become incontestable until five years after it is published, trade-mark owners are urged to republish immediately after the Lanham Act goes into effect on July 1, 1947, even though previous registration may not expire for a number of years.

Urges Reexamination of Marks

The Institute also recommends that marks denied registration under the present law be reexamined to determine whether they will qualify under the new law.

"Many trade-marks which could not be registered under the Act of 1905 will qualify for registration under the Lanham Act," the report asserts, "since the new law wipes out the distinction between the 'right to use' and the 'right to register.' In view of this fact, reexamine before next July all marks previously denied registration because they were geographic in connotation; were identical with a family or corporation name; had more than one bona fide owner; were service, association or certification marks; were not being used by the owner; were not affixed to goods, or were being used on a different type of goods."

Other recommendations in the Institute's report, "Preparing for the New Trade-Mark Law," cover ownership and use of trade-marks; qualifying a trade-mark for registration; trade-marks in foreign trade, and steps to be taken before the law goes into effect in July.

The report was drawn up for Institute members by Walter J. Derenberg, attorney and authority on trade-mark law, in collaboration with the Institute's Board of Editors. It is one of a series on current business problems prepared under the supervision of Leo M. Cherne, editor-in-chief. Others in the series include "Facing a Union Drive," "Year-End Tax Planning," "How to Reduce Payroll Taxes Under Merit Rating," and the widely discussed "Communist in Labor Relations Today."

•

Revise Metal Premium Rules

The Office of War Mobilization has revised its regulations for making premium payments to producers of copper, lead and zinc. Under the new ruling, producers may not include as part of their "reasonable costs" any increases in royalties they may have paid above the level of royalty rates in effect on November 10. It was on that date that ceiling prices on the metals, formerly used to figure premium payments, were removed. The government's premium payments of these metals are tied to the cost of production. Royalty payments by a producer to the actual owners of the land which is mined are included as a part of the cost of production.

•

English Housewives Find Dream Appliances Dreams

An England where every housewife dreams of the day when her home will be equipped with the electrical appliances so common in American homes but knows that the appliances will remain dreams for years to come, was pictured last week by Miss Joan Whitgift, senior lady demonstrator (home service director) of the Central London Electricity, Ltd., London, in an interview in New York.

Miss Whitgift, winner of the 1946 Traveling Scholarship set up by the Caroline Hazlett Trust, which each year will send an outstanding English home service director abroad to study foreign practice, is touring the eastern United States, observing the home service methods used by utilities, manufacturers, and women's publications.

The appliance situation in England is bad, Miss Whitgift said, because the

ENGLISH HOME SERVICE DIRECTOR AT E.E.I.—Miss Joan Whitgift, senior home service director, Central London Electricity, Ltd., gets some industry statistics from Miss Mae Woods, left, secretary of Edison Electric Institute

manufacturers are unable to secure the additional metal required for their post-war appliance designs so have been forced to continue their pre-war, cruder models.

The demand for appliances is terrific, and there is a waiting list for all appliances. The government has established priorities for appliances, with persons whose homes were wrecked by bombing or buzz-bombs getting first chance and leaving practically none for others.

A severe shortage of trained home service demonstrators exists because the low salaries do not encourage girls to enter this field. The work is carried on by both private and municipal power suppliers much as in America. However, all demonstrators are handicapped by the fact that food is not available for use in demonstrating cooking appliances.

There is a severe power shortage and during the past fall, electric service was cut off in many residential and commercial districts for four hours daily.

Miss Whitgift believes that nationalization of the electric utility industry will have little effect on employees or on the price of electricity. Company executives and security-holders will be affected most.

•

Edison G.E. Appliance Changes Official Name

Hotpoint, Inc., became the official name of Edison General Electric Appliance Co., January 2, under action taken by the board of directors. The new company name will carry the sub-title "a General Electric affiliate" to identify it as a part of the General Electric Co.

The company at the present time is embarking upon a major enlargement program involving $17,000,000 in capital and plant expansion in the Chicago area, which will result in the employment of several thousand additional skilled workers. The Chicago physical expansion will increase manufacturing capacities to triple present facilities for the manufacture of electric ranges, water heaters, and dishwashers, R. W. Turnbull, president, said in making the announcement.

•

Export Control Removed

Among the items recently removed from export licensing control was the following electrical equipment: electric underground mining locomotives; telephone instruments; hand generators and parts; telephone instrument parts; fluorescent electric interior lighting fix-

Crapo
STEEL CONDUCTORS

Because of its high tensile strength, its ruggedness and its conductivity, Crapo HTC-130 Steel Conductor is both practical and economical as an overhead ground wire. Its superior strength makes possible long spans with flat sags and greater clearances. Its rugged physical characteristics give it a high fatigue endurance limit, enable it to withstand severe shock and deformation.

The all-'round dependability and economy of Crapo HTC-130 Steel Conductor as an overhead ground wire have been established by its performance under actual operating conditions. Leading utilities have adopted it on the basis of their own experience.

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Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask the Graybar representative or write for your copy of the Crapo Steel Conductor Manual!

Crapo HTC-130 Steel Conductors for overhead ground wires are available in Standard (3-wire) and Solid types. Physical properties for sizes No. 4 and No. 6 (B.W.G.), in both types, are shown below:

Conductor Size B. W. G.	Type of Construction	Diameter of Conductor (inches)	Minimum Breaking Strength (lb.)
4	3-wire	0.297	5610
6	3-wire	0.252	4295
4	Solid	0.238	5784
6	Solid	0.203	4208

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Crapo HTC-130
STEEL CONDUCTORS

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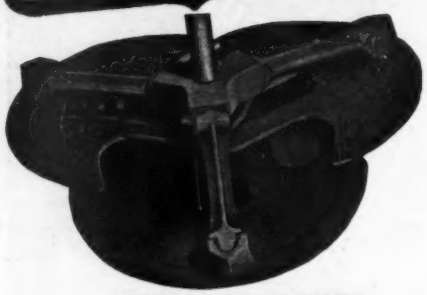

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The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough rust-resistant malleable iron. Write for bulletin.

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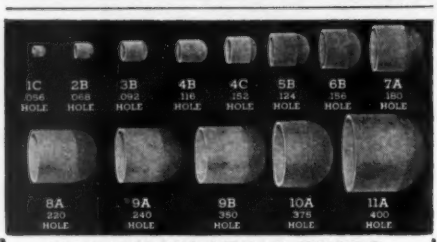

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Use LOVALAIN ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U.S.A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

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51 Muirhead Ave. Trenton, N. J.

STAR PORCELAIN COMPANY, Ltd.
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Easy To Identify Premax Markers

There'll be no mistaken identities if poles and lines are marked with Premax Metal Markers. Clear and legible at all times. Send for details.

Premax Products
Division Chisholm-Ryder Co., inc.
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tures and parts; non-fluorescent portable lamps; electric extension lighting fixtures and parts; electric underground mine drills and electric underground mine leaders.

•

General Electric Advocates Corrective Labor Laws

General Electric Co. has called for "corrective labor legislation" to restore what it termed the "balance of industrial relationships," but warned that "excess is no solution."

In a report to its stockholders, the company said:

"Any measure which seeks reprisal against unions, to put the workers at a disadvantage in collective bargaining, to turn back the clock to strike-breakers and labor-baiters, will do the nation as great a disservice as the creation of an era of strike-makers and management baiters has done."

The report stated the beginning of the nine-week strike of C.I.O. United Electrical Workers a year ago marked more than the end of "an enviable labor record." It marked, the company said, a turning point "when management's good-will and honest efforts at conciliation did not suffice, but were distorted and deliberately misunderstood, when settlement of differences between General Electric and its workers was subordinated to the weaving of a national pattern of industrial strife."

The company maintained that this proved there was a lack of balance in industrial relationships and asked for a reaffirmation of the "concept of management as a trusteeship, having three beneficiaries: owners, employees and the general public . . . "

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Seek Retention of Tariffs On Rubber Products

Arguments supporting continuation of present tariffs on various rubber products have been filed with the State Department by the rubber mechanical goods, rubber footwear and the rubber drug sundries divisions of the industry, the Rubber Manufacturers Association has announced. The briefs were directed to the Committee for Reciprocity of Information for use in the hearings which opened recently as a prelude to reciprocal trade agreement negotiations with several countries which will be conducted by the State Department in April.

Maintenance of present tariff levels, in some cases, and restoration of the higher tariff levels which existed prior to reciprocal trade agreements, in other cases, were requested by the three di-

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visions. The briefs set forth that the value of products manufactured in the divisions was about $500,000,000 in 1945. In the mechanical goods division alone, sales value of end products was about $250,000,000 and the division afforded jobs for more than 70,000 American workers.

Appeals for tariff extension were based on the grounds that the industry had encountered substantial increases in both labor and component materials costs since the present tariff rates were established.

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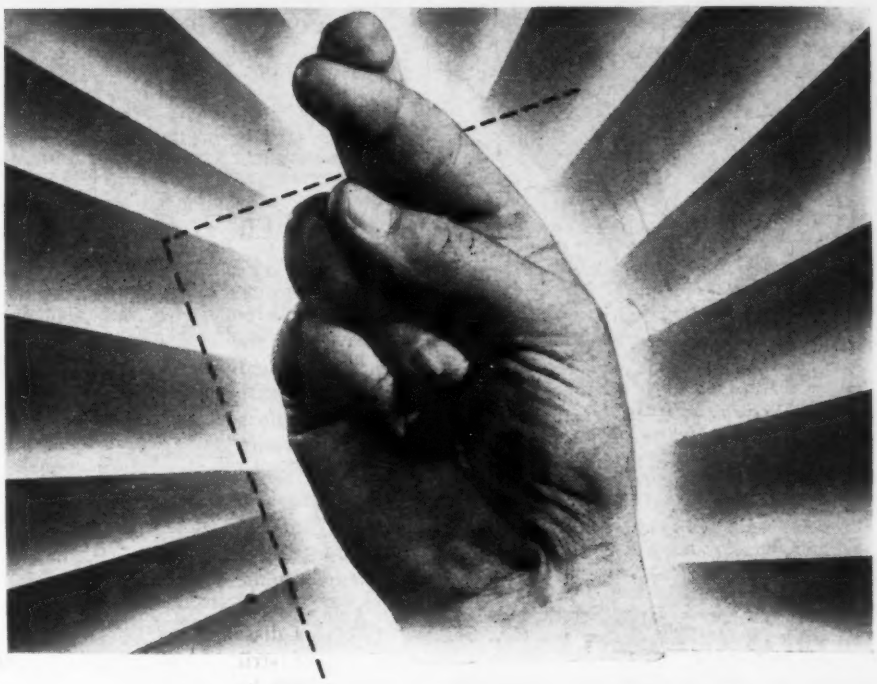
Manufacturers Announce Plant Expansion Plans

John A. Roebling's Sons Co., Trenton, N. J., has announced that the company plans a $6,000,000 program of expansion and new equipment in 1947. In announcing the program, Charles R. Tyson, president, said: "We feel that the stage is set for a year of excellent production provided the availability of raw materials is adequate and there are no interruptions in the working schedules. . ."

Utility Automotive Equipment Co. has announced the opening of a new plant in Ottawa, Ont., for the manufacture of steel truck bodies, pole and installer trailers for utility and petroleum industries, insulated liquid containers, highway emergency safety flares and other articles. The new plant comprises the main factory building, 102 x 225 ft., a 19 x 120 paint and finishing building, a 20 x 40 boiler room and a temporary office building. M. F. Sherlock is president and general manager.

Opening of a new Atlanta factory branch and warehouse of the General Detroit Corp., manufacturers of fire extinguishers, motorized fire apparatus, and allied equipment, has been announced by E. A. Warren, vice-president in charge of sales. The new office is located at 285 Spring Street N. W., Atlanta 3, Ga. J. H. Gaines has been appointed southeastern regional sales manager in charge. The Atlanta office will serve the states of Alabama, Florida, Georgia, Mississippi, South Caroline, and Tennessee.

Lasser Mfg. Co. has acquired a new and larger plant in Miami, Fla. The new building, completely modern throughout, takes in a square block and has excellent rail and highway facilities including a private siding on the Florida East Coast Railroad main line. General offices will be in the building at 40 N.E. 22nd St.



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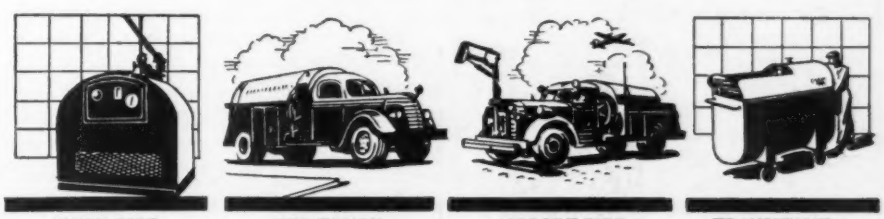

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Recent Rate Changes

PUBLIC SERVICE CO. OF COLORADO's electric rates will be reduced by $1,250,000 annually in Denver under terms of the new franchise drawn up for the city and county. This means a cut of about 13 percent in electric revenues for the area. Residents are to vote on the proposed new franchise at a special election set for February 11, next.

PUBLIC SERVICE CO. OF NEW HAMPSHIRE has announced an electric rate reduction of $303,000 annually, effective February 1. The new reductions will bring the average cost of electricity to residential customers to 4.02 cents per kilowatt-hour. Residential customers will have their rates reduced $218,000 a year by the new schedules and commercial users will save $85,000 annually.

CENTRAL ILLINOIS LIGHT CO. has been ordered by the state Commerce Commission to reduce rates in Peoria and DeKalb areas to the extent of $265,000 annually, but found no reason for reductions in the Springfield area. The new reductions will become effective February 1.

WISCONSIN POWER & LIGHT CO. has been authorized by the state Public Service Commission to adjust its electric rates and rules affecting summer cottage customers. Under the new rates approved, about 6,300 season customers would save $3,780 a year in electric rates. This is offset, however, by an increase of $7,182 to 3,150 customers who disconnect at the end of each summer season. The new rates permit the utility to charge $5 for each reconnection made and $2 for transferring an account during the season.

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Manufacturers Issue Earnings Statements

Among the electrical manufacturers who have recently issued statements of earnings are the following:

EMERSON ELECTRIC MFG.—Year to September 30, net loss, $410,044, after including $1,009,234 carry-back tax credit, contrasted with net income in previous fiscal year of $1,271,664, equal to $2.61 a common share; net sales, $11,887,527, compared with $60,226,469. Current assets on September 30, last, were $7,303,247, and current liabilities, $2,278,896.

ROBBINS & MYERS—Quarter to November 30, net income, $123,987, equal to 55 cents each on 147,705 common shares, on net sales of $2,512,802.

THOMAS A. EDISON, INC.—Including wholly owned subsidiaries, sales of $13,494,075 for first nine months of 1946 and $4,650,092 for three months ended September 30. Consolidated net profit, $245,364 for nine months and $211,130 for three months, after giving effect to estimated carry-back tax credits of $605,000 and $288,000 respectively. Net profit for nine months is equal, after deducting dividend requirements on preferred, to 43 cents per share of common stock.

ANACONDA WIRE & CABLE—Nine months to September 30, net profit of $2,100,301, or $4.98 a share, comparing with $640,503, or $1.52 a share for the first nine months of 1945.

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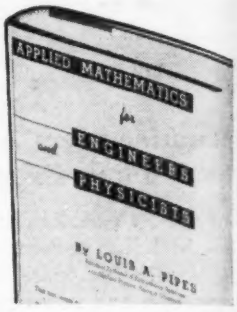

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